NAVAL POSTGRADUATE SCHOOL
Monterey, California

THESIS

A FLOW MODEL OF THE U.S. ARMY FIELD GRADE OFFICER CORPS TO PRODUCE THE FIVE YEAR PROMOTION PLAN

by

William R. Thompson

September 1985

Thesis Advisor: J. B. Gafford

Approved for public release; distribution is unlimited.

SECURITY CLASSIFICATION OF THIS PAGE (When Data Entered)

REPORT DOCUMENTATION PAGE	READ INSTRUCTIONS BEFORE COMPLETING FORM
1. REPORT NUMBER	2. GOVT ACCESSION NO. AD A162268	3. RECIPIENT'S CATALOG NUMBER
4. TITLE (and Subtitle) A Flow Model of the U.S. Army Field Grade Officer Corps to Produce the Five Year Promotion Plan	5. TYPE OF REPORT & PERIOD COVERED Master's Thesis September, 1985 6. PERFORMING ORG. REPORT NUMBER
7. AUTHOR(s) William R. Thompson	8. CONTRACT OR GRANT NUMBER(s)
9. PERFORMING ORGANIZATION NAME AND ADDRESS Naval Postgraduate School Monterey, California 93943-5100	10. PROGRAM ELEMENT, PROJECT, TASK AREA & WORK UNIT NUMBERS
11. CONTROLLING OFFICE NAME AND ADDRESS Naval Postgraduate School Monterey, California 93943-5100	12. REPORT DATE September, 1985 13. NUMBER OF PAGES 147
14. MONITORING AGENCY NAME & ADDRESS(if different from Controlling Office)	15. SECURITY CLASS. (of this report) 15a. DECLASSIFICATION/ DOWNGRADING SCHEDULE

16. DISTRIBUTION STATEMENT (of this Report)

Approved for public release; distribution is unlimited.

17. DISTRIBUTION STATEMENT (of the abstract entered in Block 20, if different from Report)

18. SUPPLEMENTARY NOTES

19. KEY WORDS (Continue on reverse side if necessary and identify by block number)

DOPMA, OPMS, MILPERCEN, Officer Promotions, Manpower Planning, Five Year Promotion Plan, Computerized Flow Model, Networks

20. ABSTRACT (Continue on reverse side if necessary and identify by block number)

This thesis analyzes the methods used to produce the U.S. Army Five Year Field Grade Officer Promotion Plan. The officer promotion system is formulated in terms of personnel flows. Calculations used within the system are then consolidated to present a promotion model.

The current microcomputer implementation of the promotion model is presented, showing severe limitations as an analytical tool.

DD FORM 1 JAN 73 1473 EDITION OF 1 NOV 65 IS OBSOLETE

S N 0102-LF-014-6601

SECURITY CLASSIFICATION OF THIS PAGE (When Data Entered)

20. A mainframe implementation is then demonstrated, showing significant advantages over the previous technique. The proposed flow model Proplan offers to the force planner a tool which accurately produces the promotion plan. Other characteristics of Proplan show that this implementation is flexible, responsive, and should be used to produce the promotion plan.

Approved for public release; distribution is unlimited.

A Flow Model of the U.S. Army Field Grade Officer Corps to Produce the Five Year Promotion Plan

by

William R. Thompson
Captain, United States Army
B.S., United States Military Academy, 1978

Submitted in partial fulfillment of the requirements for the degree of

MASTER OF SCIENCE IN OPERATIONS RESEARCH

from the

NAVAL POSTGRADUATE SCHOOL
September 1985

Author: William R. Thompson
William R. Thompson

Approved by: Jake B. Gafford
J.B. Gafford, Thesis Advisor

R. Kevin Wood
R. Kevin Wood, Second Reader

A.R. Washburn
A.R. Washburn, Chairman,
Department of Operations Research

K. T. Marshall
Kneale T. Marshall,
Dean of Information and Policy Sciences

ABSTRACT

This thesis analyzes the methods used to produce the U.S. Army Five Year Field Grade Officer Promotion Plan. The officer promotion system is formulated in terms of personnel flows. Calculations used within the system are then consolidated to present a promotion model.

The current microcomputer implementation of the promotion model is presented, showing severe limitations as an analytical tool. A mainframe implementation is then demonstrated, showing significant advantages over the previous technique. The proposed flow model Proplan offers to the force planner a tool which accurately produces the promotion plan. Other characteristics of Proplan show that this implementation is flexible, responsive, and should be used to produce the promotion plan.

TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

I. INTRODUCTION

This thesis focuses on the problem of forecasting the promotion of officers within the United States Army. The agency required to perform this analysis is the Military Personnel Center (MILPERCEN), located in Washington, D.C. The problem that MILPERCEN currently faces is that attrition in the higher ranks is slower than projected. This causes relative stagnation in the intermediate ranks as characterized by extremely long promotion list durations. The concern is that this may have an adverse impact on the career expectation of high quality officers in the near future.

This thesis specifically analyzes the U.S. Army Five Year Field Grade (FG) Officer Promotion Plan. This will be referred to as the promotion plan as an abbreviation for the remainder of this thesis. The objectives of this thesis are to:

1. Formulate a promotion model which describes the flows and required calculations within the officer promotion system (Chap. III).
2. Describe the current implementation of the promotion model titled the 'Microplan' (Chap. III).
3. Develop and demonstrate a computerized officer flow model to produce the promotion plan titled the 'Proplan' (Chap.IV).
4. Demonstrate a set of typical MILPERCEN exercises using the Proplan and exec programs (Chap V).

Within the FG ranks of the U.S. Army, slow attrition at the higher ranks has specifically caused promotion timing guidance to be violated. MILPERCEN is now faced with some very difficult issues, which require an analytical capability not present with the current implementation of the

promotion model. This means that force planners at MILPERCEN are doing much of their analysis using manual techniques which are slow and subject to error. These issues include:

1. How to speed up promotions?
2. Whether to accept long promotion lists and reschedule promotion boards?
3. Whether to leave the system as it is?

The problem is a relatively common one in manpower planning and can be described in general terms as follows:

1. Given budgetary limitations which restrict the number of people who can be employed at each rank,
2. Given policies on promotion flows,
3. Given other variables, such as attrition, which are difficult to control,

what should the promotion plan be for the next five years? The analytical tools to aid decision makers at MILPERCEN to make these decisions are limited at this time. To further this aim, this thesis develops a computerized officer flow model Proplan which will aid force planners to better manage promotions to the FG ranks. Proplan is a significant improvement over the current implementation of the promotion model. Some of the improvements within Proplan include:

1. Revised data input procedures which reduce changes for error.
2. Correction of a number of calculation errors.
3. An efficient Fortran program which could be imbedded into a simulation or exec programs.
4. Revised methods to change input assumptions and execute the model again.

Some improvements have already been made in the management of Army officers. These have been required because of a series of personnel management changes in the last few years. The most significant of these changes has been the

enactment of the Defense Officer Personnel Management Act (DOPMA). DOPMA places a number of constraints and guidelines on the promotion of officers. This requires managers to keep close track of the number of officers in each grade, and of the career flow of officers within year groups.

Officer promotion policies interact with, and are affected by, a number of other manpower related activities. The promotion planner must first forecast promotions so that DOPMA guidelines are met as closely as possible. This is done under a set of assumptions regarding internal and external variables. An idea of what the promotion plan may look like is then generated, given that the assumptions of the plan remain constant. It is important to realize though that promotion policies affect other activities, where the interaction is not obvious or easily quantifiable in most cases. A few of these areas that may have a substantial effect on the promotion plan are listed below:

1. The officer ascession plan of each year.
2. The officer salary and compensation plans.
3. The general state of the civilian economy.
4. The size of the officer corps.

The result of these interactions is that a model which projects promotions of officers in the Army may not be able to exactly represent each of these activities. The force planner must be able to stay abreast of these activities though so that major changes can be incorporated to the degree that the model allows. Any model is also used with a high degree of uncertainty and can only generate rough point estimates.

Coordination of management policies is also critical, as changes will many times dramatically affect the size, structure, and composition of the future officer corps. To help manage this complex system, MILPERCEN has recently started the development of a more sophisticated personnel data base.

The need is obvious when one considers that there are nearly 80,000 commissioned officers in the U.S. Army today. The management of this data base is still in infancy though, and the real benefits for forecasting promotions may be years in the future.

The current state of officer personnel management is that the tools of management at MILPERCEN are complex, historical records are inadequate, and the requirements for management are accelerating. Within MILPERCEN, the agency tasked with trying to overcome these problems is a section known as the Officer Force Planning (PLF) section. As a field operating agency of the Deputy Chief of Staff for Personnel (DCSPER) at the Pentagon, this section is staffed with Operations Analysts who try to forecast what the officer corps will look like in the future. The five year promotion plan is produced in September of every year, but projects related to the promotion plan occur year round. Many of these are projects for the DCSPER in response to how the promotion plan would be affected given changes to the model's assumptions. These changes must then be incorporated into the promotion plan, and their effect on all phases of the output must be analyzed. Consequently, the need for speed, flexibility, and reliability must be built into the promotion plan development. The promotion plan must also be documented so that an analyst not involved with the details of the promotion system can easily understand the output, or run the model himself if needed. The model must also provide output in a form which can be briefed to and understood by decision makers not taking part in the analysis.

Changes in management practices must be viewed within the context of the needs of the officer corps. A few of these needs include satisfying expectations for career progression, job security, and career stability. It is

within this context that MILPERCEN publishes yearly a five year promotion forecast with the following objectives clearly in mind:

1. Provide for an effective management system that insures an appropriate distribution of officers of desired maturity and experience in the various grades.
2. Provide relatively similiar promotion opportunity over a period of 5 years within a competitive category.

Both of these objectives have been incorporated into the Defense Officer Promotion Program [Ref. 1], which institutionalizes the promotion philosophies of DOPMA. This reference also gives guidance to MILPERCEN for promotion forecast reporting requirements.

II. BACKGROUND

A. HISTORICAL DEVELOPMENT OF DOPMA

In order to fully understand the philosophy and need for the promotion plan, it is necessary to briefly review the development of DOPMA. Some common trends run through all stages of officer corps management. Four topics will be discussed as they relate to management of the officer corps. These are:

1. The continuation of up-or-out promotion practices.
2. The growing size of the regular force.
3. The stricter control of the military by Congress.
4. Congressional Acts prior to DOPMA.

1. Up-or-Out Promotion Practices

Up-or-out promotion systems are basically characterized by systems which force officers out of the system when they are no longer competitive for promotion. The alternative is to promote by seniority, regardless of talent or potential. The main difference is in how vacancies are created when not in periods of a buildup. Under DOPMA, up-or-out promotion practices have been reinforced and standardized among the services. The promotion systems within the services have slowly developed from pure seniority based systems in the early 1800's, to systems based more on recognized potential. An important point though is that DOPMA allows officers who have achieved seniority to remain on active duty until retirement, even if not selected for promotion. This idea is incorporated into the selective continuation provisions of DOPMA.

The basis of the up-or-out system of promotion is the orderly creation of vacancies at all grades. This has

been shown to be important so that ambitious young officers have a secure career expectation. The term used by the Navy for creating vacancies in the 1940's was 'plucking' officers [Ref. 3: p.14], as the Navy then demonstrated that creating vacancies only in the highest ranks did not have a significant effect on the intermediate grades. Also shown in the 1940's was that the promotion system had to be very closely tied to the retirement system in order to insure an orderly progression of promotions.

2. Size of the Regular Force

The idea of a small regular force which would be augmented by a large, but virtually untrained, corps of militia officers has changed somewhat in the enactment of DOPMA. The DOPMA basis for the need of a larger standing Army are that:

a) Shorter lead times are expected for mobilization in future wars.
b) The increased projection of military power during peacetime is expected.

Both of these demands require a larger, well trained corp of officers of high quality. This high quality is gained through sufficient turnover to allow leaders to gain experience, while maintaining a degree of maturity within the officer corps [Ref. 4: p.2]. DOPMA has enacted measures which attempt to allow sufficient turnover while managing career progression of a larger officer corps.

3. Control of the Military

Congress has traditionally placed stringent controls on the size, structure, and organization of the officer corps. The main ideas are that there should first exist a proper ratio of officers to enlisted, and secondly that there should exist a grade distribution within the officer corps. These requirements are commonly enacted in the form

of 'grade tables', and are used extensively for force structure planning. The long run effects of congressional interest in the management of the officer corps have resulted in the following trends:

a) A struggle by the armed forces to insure their own goals are achieved.
b) An increasing complexity of the management process.
c) A continual movement toward standard promotion practices and policies among the services. [Ref. 4: p.179]

4. Congressional Acts Prior to DOPMA

There were two main acts which provided a long range management framework for the officer corps prior to DOPMA. These were the Officer Personnel Act of 1947 (OPA) and the Officer Grade Limitation Act of 1954 (OGLA).

The OPA advanced the idea of the up-or-out promotion system by granting the Army and Air Force the right to promote by selection, the system used by the Navy since 1916 [Ref. 4: p.184]. This act also set up the idea of cohort groups of officers who would be considered for promotion, separation, or retirement at the same times [Ref. 5: p.8]. The main concerns of this act were to establish an appropriate grade distribution, and to set up a means to manage the officer corps through the grouping of officers.

The OGLA was enacted because of excessive numbers of senior officers in each service and the widespread use of temporary promotions at the time. The act also imposed statutory limits on the number of officers serving in the grades of O-4 and above (FG). This act still allowed significant differences between the services so that a number of temporary laws were enacted until 1972. It became obvious by 1972 that a review of the grade distribution requirements of the armed forces as a whole was needed.

This need, and the studies that followed, brought about DOPMA. [Ref. 5: p.11]

B. THE PHILOSOPHY OF DOPMA

The primary driving forces behind all the studies which generated DOPMA were the size of the active duty force and of the officer grade distribution. The size of the regular force was expanding to meet security needs in the early 1970's and exceeded both the OPA and OGLA authorizations [Ref. 6: p.1]. The Army, in enacting the requirements of DOPMA, created a management system entitled the Officer Personnel Management System (OPMS). Many of the provisions of OPMS have little to do with the promotion plan, and only those which have a direct bearing on this thesis will be addressed.

DOPMA provides uniform promotion laws, uniform management practices, and common tenure rules in the grades O-1 through O-6 among the services. The major provisions of the act provide for:

1. New permanent grade limitation tables for the FG ranks.
2. A single permanent promotion structure that is the same for all the services.
3. Standardized career patterns.
4. Selective continuation procedures for FG officers. [Ref. 6: p.2]

The ultimate objectives of DOPMA with respect to promotions of FG officers can be described in terms of the objectives of the uniform grade tables. These objectives are general in nature, but do summarize the promotion philosophy of the DOPMA provisions. Career opportunity is consistently mentioned within these objectives. This term is defined as the chance that an officer has of making a career out of

being an Army officer. Not all officers are guaranteed a career, as the officers required decreases as rank increases. Frequent phasedowns, where a large number of officers would be forced to leave the service, would not be beneficial to the objectives of DOPMA. The objectives of DOPMA are:

1. To allow the services to meet requirements for officers in the various grades with the appropriate amount of experience.
2. To provide a career opportunity that will attract and retain officers of high caliber.
3. To provide consistent career opportunity among the services. [Ref. 5: p.14]

The overall goals of DOPMA then are to provide a sense of stability, offer common expectations for promotion, and provide career opportunities which are similiar for all officers.

C. THE U.S. ARMY PROMOTION SYSTEM UNDER DOPMA

The promotion process of the U.S. Army is governed by specific DOPMA constraints. These constraints impose major changes on the promotion system, and require a major analytical effort to produce the promotion plan. The organization for presenting the specific DOPMA constraints and major changes from the previous promotion system will be as follows. First, DOPMA provisions which provide for the creation of a single active duty list (ADL) and rules for competitive categories will be presented. Then, the promotion board process and terms used in establishing promotion lists will be discussed. New provisions in this area include revised retirement and selective continuation rules. Finally, actual DOPMA constraints within which the promotion process must operate will be presented.

1. The Single Active Duty List

Prior to the enactment of DOPMA, the U.S. Army maintained a complicated promotion system based on a series of temporary and permanent promotions. This meant two separate selections for promotion at each grade. One for temporary grade, which was the initial change of insignia and increase in pay grade. The second promotion was termed a permanent promotion and sometimes had a significant impact on career expectation. In order to reduce the complexity of this cumbersome system, DOPMA provides for a single ADL. This list contains the names of all commissioned officers in the grade of 2nd Lieutenant and above on active duty. Officers which are excluded from this requirement include retired officers and certain reserve officers [Ref. 5: p.24]. The active duty list is used to establish seniority within each grade by ranking all officers with the same grade by their date-of-rank (DOR). This list is further used to establish eligibility for promotion and insure promotion timing is maintained by establishing promotion zones. It is through the establishment of this single ADL that the mechanics of the promotion process are implemented.

2. U.S. Army Competitive Categories

A competitive category is a group of commissioned officers who compete among themselves for promotion. Officers within a competitive category are actually promoted based on rank order. These promotions occur as additional vacancies at the next higher rank are created within that competitive category. The U.S. Army maintains nine competitive categories, the largest of which is the one managed by the Officer Personnel Management Directorate (OPMD). These officers are categorized as 'Army', and are the only officers included in the promotion plan. The other competitive categories hold their own promotion boards and are managed

under separate grade distribution tables. These other categories include special branch officers from the Chaplain Corps, Judge Advocate General Corps, and the separate branches of the Army Medical Department. The result is that the majority of U.S. Army officers are now managed under a single consolidated ADL and within a single promotion process.

3. The Promotion Selection Board Process

A separate selection board is convened for each competitive category and grade. These promotion boards recommend officers for promotion based on Secretary of the Army guidance and instructions. The information of interest that is provided to the promotion board is the maximum number of officers to be selected for promotion within each promotion category [Ref. 8: p.5]. This is the part of the instructions that the promotion plan plays a critical role in. The promotion plan is actually used to provide the boards with guidelines on the percentages of officers to select for promotion from those considered. The promotion board may vary these somewhat based on the actual files received, so long as no absolute constraints are violated. This usually means not selecting too many officers for early promotion. A promotion board does have a high degree of flexibility in this area, which adds another degree of uncertainty to promotion forecasting.

Once officers are recommended and approved for promotion, their names are placed, in order of seniority, on promotion lists. Officers are then actually promoted, within each competitive category, as vacancies occur in the next higher rank. These promotions proceed by seniority on the list until the list is exhausted, without any real time constraint on how long the list lasts. Also important is that the promotion list does not start until all previous

lists for that same grade and competitive category have been exhausted. As will be seen, this may result in a backlog of promotion lists under periods of slow losses at higher ranks.

D. SPECIFIC DOPMA CONSTRAINTS

Now that the most important aspects of the administration of the promotion process have been presented, the actual DOPMA constraints which affect the promotion system are considered. DOPMA constraints on promotion flow are not currently being met. There exists a conflict among the competing objectives of the system so that it may be necessary to make tradeoffs of these objectives. These tradeoffs need to be analyzed in terms of how constraints are affected if only one is strictly adhered to, or if all of the constraints are relaxed to a certain degree. This gives some idea that priorities may be set on the constraints, and a means of measuring the interaction of the constraints is needed.

The clarification of certain terms must be briefly mentioned at this time in order to allow a discussion of these constraints. A complete glossary of manpower specific terms which are useful in understanding the promotion plan is also presented in Appendix A.

The promotion system utilized by the Army is, for all practical purposes, a hierarchial system as there are no demotions, promotions are to the next higher grade only, and the majority of the recruitment is to the lowest grade.

The officer system is composed of structured grades, or ranks. This structure is presented in Table 1, which shows that there are basically seven grades in the Army by combining all General grades into one. Of these, the only grades modelled by the promotion plan are the grades 0-3 through 0-6.

TABLE 1

OFFICER RATINGS OF THE U.S. ARMY

Grade	Rank
O-1	2nd Lieutenant (2LT)
O-2	1st Lieutenant (1LT)
O-3	Captain (CPT)
O-4	Major (MAJ)
O-5	Lt. Colonel (LTC)
O-6	Colonel (COL)
O-7 and beyond are	Generals

Each grade is composed of groups of officers who are considered for promotion as they enter promotion zones. These zones are based on DOR so that officers within a year group are normally considered at the same time. The promotion zone is a subset of the ADL specifying the most senior and junior officers to be considered for promotion.

There are also three categories of officers which are considered for promotion based on years of service. Below zone (BZ) refers to officers on the ADL who are eligible for promotion consideration and whose DOR is junior to any officer in the primary zone (PZ). In zone (IZ), or primary zone, refers to those officers who are eligible for promotion consideration for the first time for a particular rank (excluding BZ). Above zone (AZ) refers to those officers who are eligible for promotion consideration whose DOR is senior to any officer in the PZ. Officers in the AZ category have been failed to select at least once in the PZ, and fall into the selective continuation category when twice having failed to be selected.

A due course officer is an officer who has never failed to be selected from the IZ when first considered and has never been selected from the BZ to any grade. The due

course officer is one who has made all promotions on time and, in this sense, is the average officer for whom DOPMA constraints are closely managed. With these terms in mind, the following DOPMA constraints are imposed on the promotion process.

1. Grade Table Ceilings

The authorizations for FG officers (O-4 to O-6) are controlled by a ceiling on total number of officers in each of these grades. The allowance for FG officers is expressed in law as a number of officers in relation to the strength of the officer corps as a whole. Fluctuations in the size of each of these grades occur as the size of the total Army changes and is based on a sliding scale principle. This basically means that the proportions of officers within each grade are not the same for all sizes of the officer corps. These ceilings must not be exceeded at the end of each fiscal year as the budget is closely tied to these figures. An example of the sliding scale principle is shown in Table 2. This table shows that the proportion of officers at the higher ranks increases as the size of the commissioned officer force decreases [Ref. 6: p.32].

The actual authorizations for FG officers are specified for the U.S. Army as a whole before the start of the fiscal year. The grade distribution is then further broken down to each competitive category based on the perceived needs of that category. This adds flexibility to the high level force planners as only the total active Army needs to meet budgeted end strength at the end of a fiscal year. At the same time, this adds another degree of uncertainty for promotion planning within each competitive category as requirements may change within a fiscal year.

TABLE 2

FIELD GRADE OFFICER GRADE TABLE

Total Number of Officers	Percentage at each rank COL	LTC	MAJ
70,000	3,706 (5.29%)	9,244 (13.21%)	13,396 (19.14%)
75,000	3,896 (5.19%)	9,587 (12.78%)	14,242 (18.99%)
80,000	4,085 (5.11%)	9,933 (12.42%)	15,065 (18.83%)
85,000	4,265 (5.02%)	10,267 (12.08%)	15,911 (18.72%)

2. Promotion Timing

The promotion timing under DOPMA is managed by both minimum time-in-grade (TIG) and time-in-service (TIS) constraints. These constraints are managed by the promotion system in order to provide similiar career expectations for all YGs and allow for similiar promotion flows between YGs. Minimum TIG constraints are shown in Table 3 which shows that the minimum is the same for all FG ranks.

TABLE 3

MINIMUM TIME IN GRADE CONSTRAINTS

Promotion to	Minimum
MAJ	3 years
LTC	3 years
COL	3 years

Once minimum TIG requirements are met, promotion to the next higher rank is generally governed by DOPMA windows on Active Federal Commissioned Service (AFCS). These are shown as preferred guidelines in Table 4, and are called the promotion windows for each grade.

TABLE 4

TIME IN SERVICE CONSTRAINT

Promotion to	Years AFCS
MAJ	10 (+/- 1)
LTC	16 (+/- 1)
COL	22 (+/- 1)

3. Promotion Opportunity

Each officer receives four main chances to be promoted. These include a BZ chance one year prior to the primary zone, an IZ chance, and two AZ chances during the two years following the IZ consideration. If continued after having been twice non-selected, the officer remains eligible for promotion until separated or retired. The chances for promotion are much smaller if selectively continued as compared to the four other chances. DOPMA sets minimum cumulative promotion opportunity constraints as shown in Table 5 for each YG.

4. Below Zone Promotion Constraint

DOPMA further constrains the promotion system by allowing only a specified number of promotions from below the zone (BZ). DOPMA specifically authorizes a maximum of 5% of the promotion list to MAJ and 10% of the promotion

TABLE 5

PROMOTION OPPORTUNITY CONSTRAINT

Promotion to	Cumulative Opportunity
MAJ	80 %
LTC	70 %
COL	50 %

list to LTC and COL to come from officers in the BZ category. Allowance is made for these numbers to be increased if needed, but much fewer than these maximum percentages were actually selected during past promotion boards.

E. SELECTIVE CONTINUATION AND RETIREMENT

The last major constraints that DOPMA imposes on the promotion process are the handling of officers who are twice non-selected for promotion (2XNS), and the mandatory retirement times for each grade. These will be discussed for each grade.

A CPT 2XNS is an officer who has been twice considered, but not selected, for promotion to MAJ. Prior to DOPMA, a CPT 2XNS would normally be separated from the service. DOPMA provides that a CPT 2XNS is allowed to remain until 20 TIS, if selectively continued. [Ref. 5: p.25]

A MAJ 2XNS may also remain until 24 years TIS, if selectively continued. This is in comparison to the normal retirement point for MAJs of 20 years TIS. Actual retirement points are left to the discretion of the Service Secretary. DOPMA expresses a desire for the majority of MAJs who go before a selective continuation board to be continued to 20 years TIS. [Ref. 5: p.28]

Officers who are LTCs and are 2XNS may also be required to go before a selective continuation board. For those who do, at least 70% of those considered must be retained. Those selected for continuation would continue until 26 years TIS and retire at that point, if not selected for promotion sooner. [Ref. 5: p.53]

Officers who are COLs and have four or more years TIG may also be required to go before a selective continuation board. Retirement for those selected to continue, if not promoted to general officer rank sooner, is 30 years TIS. [Ref. 5: p.53]

The fundamental idea of this discussion of selective continuation and retirement is that the majority of FG officers who want to remain on active duty until retirement, are allowed to do so. This is in recognition of seniority and contribution to the service considerations, although the primary consideration must be the needs of the service. DOPMA does allow the Service Secretary to discontinue FG officers however, so some flexibility is retained.

F. SUMMARY OF THE PROMOTION SYSTEM

DOPMA has placed a number of guidelines and constraints on the officer promotion system. These guidelines are established so that the Army has goals on grade distribution, promotion timing, and end strength requirements. As manpower related costs are one of the highest expenditures of the services, Congress plays an active role to insure that the DOPMA guidelines are enforced. The promotion plan serves as one of the primary reporting documents on how well the Army is meeting these guidelines. This requires that the promotion plan be an accurate representation of the promotion system, and a tool which the force planner can use to provide meaningful forecasts.

The personnel flows within the promotion system are managed so that DOPMA guidelines are met as closely as possible. These flows are classified in a simplified manner in Figure 2.1, where the ranks of interest are delineated.

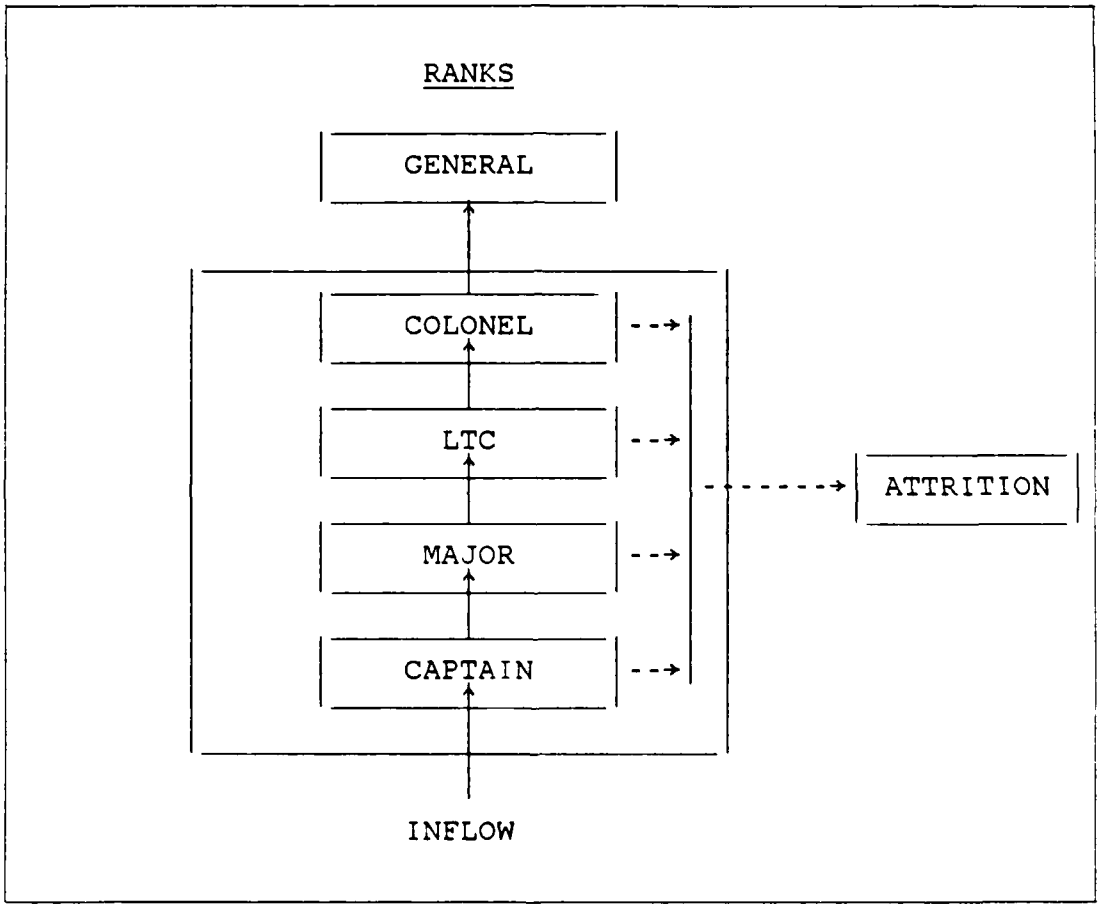


Figure 2.1 Simplified Flows of the Officer System

These flows will be discussed in great detail in the next chapter as the promotion model is formulated. The important points of Figure 2.1 are that the system has a hierarchial structure, and movement upward in the grade structure is dependent on flows which occur at the next higher rank. This also means that actions which occur at the higher ranks

have a large effect on the lower ranks. These flows are categorized as inflows, outflows, internal flows and structural changes as defined below:

1. Inflows - promotions to CPT.
2. Internal - promotions within the system.
3. Outflows - attritions and promotions out of the system.
4. Structural - End strength changes to each rank.

III. MODELLING THE PROMOTION SYSTEM

One of the requirements that Congress has placed in DOPMA is the projection of promotion plans by each of the armed services. This promotion plan is submitted to Congress in September of each year, coinciding with the POM process. In developing their promotion plan, MILPERCEN must also model the officer promotion system so that the information requirements within the Defense Officer Promotion Report are met [Ref. 1: pp.3,4]. The main purpose of this promotion plan is to provide guidelines to promotion boards on the number of officers to consider within each promotion category for the coming board year. This is a process of insuring that the constraints of the previous chapter are met, and then making a projection on the number of vacancies which are expected in each of the next higher grades. In making these projections, MILPERCEN insures that officers within a competitive category are afforded relatively similiar opportunities for promotion. However, they do not insure that promotion timing constraints are met.

There is a relatively high degree of uncertainty as to the number of vacancies which will be created at each grade. The current solution to the promotion plan solves this problem by making simplifying assumptions to insure that the promotion opportunity constraint is met. Promotions are then projected based on attritions, with the assumption of continuity of the system for five years.

The current implementation of the promotion model is automated using Lotus 1-2-3 and is named the Microplan. This compares with the previous method of generating the promotion plan by manual spreadsheet. The Microplan is more efficient than a manual spreadsheet and more reliable in generating the promotion plan, once the data is input for a

simple run of the model. The Lotus 1-2-3 program has experienced some difficulties in generating sensitivity checks because the program was built to handle only small changes in the system. Some other very important limitations are:

1. Difficulty in incorporating minor improvements or additions.
2. Difficulty in interpreting results unless the analyst has a high degree of experience with the Lotus 1-2-3 software.
3. Difficulty in generating correct results when executing the model repetitively.

A mathematical formulation of the flows and calculations required within the promotion system will now be presented. This formulation presents assignments and calculations that will be used in both the current implementation Microplan and the proposed flow model Proplan. For this reason, the term 'promotion model' will be used to identify the mathematical formulation of the promotion system. Emphasis will be on the input and output data at each stage of the promotion model. A short description of the implementation problems of Microplan will then conclude this chapter. Microplan does have some serious implementation limitations. These limitations will be more completely defined and corrected in the implementation of the new flow model Proplan.

A. PROMOTION MODEL FORMULATION

The promotion system for the FG ranks of the U.S. Army is formulated in terms of ordered computations. A number of dependent and independent variables are defined in this formulation. In general, independent variables are the input variables. Dependent variables are calculated once

the required inputs are given. Each of these will be further classified as promotion flow or promotion list variables. Promotion flow variables are identified with the movement of officers or space allocations. Promotion list variables are used to identify the characteristics of the promotion lists at each rank.

Timing in the formulation is based on a FY starting with t=1. The transformation from t to actual FY is FY=t+83. Time period t=1 is identified as the current board year for the formulation. At the end of the t=1 time period, the promotion lists for FY85 (t=2) are known and lists remaining brought forward from previous FYs are known. Promotion flow variables are calculated first for t=2, specifying the current promotion list characteristics. This means that t=1 is the index for previous lists not exhausted, t=2 is the current FY, and t=3 to t=7 are the 5 years forecasted.

1. Notation for the Promotion Model

Notation for the promotion model is now given in terms of the indices, promotion flow, and promotion list. The following notation is used for the formulation of the promotion model:

Indices

i=Index for pay grade, or rank	i=3,4,5,6 3=CPT 4=MAJ 5=LTC 6=COL
t=Index for time period in FYs	t=1,2,...,T
T=Planning horizon in FYs	T=7
τ=Index for time period in FYs when the time period is a function of the input data or T	τ=2,3,....

Promotion Flow Notation

$L_i(t)$=Losses from rank i for t=2,...,T

$D_i(t)$=Delta from rank i

$P_i(t)$=Promotions from rank i

$PC_i(t)$=Promotion Capability to rank i

Promotion List Notation

$BC_i(t)$=BZ consideration for promotion to rank i

$BS_i(t)$=BZ selection for promotion to rank i

$IC_i(t)$=IZ consideration for promotion to rank i

$IS_i(t)$=IZ selection for promotion to rank i

$AC_i(t)$=AZ consideration for promotion to rank i

$AS_i(t)$=AZ selection for promotion to rank i

$LR_i(t)$=Promotion list remaining at the start of time period t

$CSY_i(t)$=Years in service at promotion to rank i

$CSM_i(t)$=Months in service at promotion to rank i

$LS_i(t)$=Promotion list size for time period t

$PR_i(t)$=Promotion rate to rank i

$LD_i(t)$=Promotion list duration for each list

AO_i=AZ promotion opportunity to rank i

IO_i=IZ promotion opportunity to rank i

BO_i=BZ promotion opportunity to rank i

2. Promotion Outputs

Promotion Flow Outputs

$$PC_i(t)=L_i(t)+P_i(t)+D_i(t) \quad i>3,\ t=2,\ldots,T \qquad \text{(eqn 3.1)}$$

$$P_{i-1}(t)=PC_i(t) \quad i>3,\ t=2,\ldots,T \qquad \text{(eqn 3.2)}$$

Promotion List Outputs

List Size

$$LS_i(1)=LR_i(1) \qquad i>3$$

$$LS_i(2)=AS_i(1)+IS_i(1)+BS_i(1) \qquad i>3$$

$$LS_i(t+1)=AS\ (t)+IS_i(t)+BS_i(t) \qquad i>3,\ t=2,\ldots,6$$

where: $AS_i(t)=AO_i*AC_i(t)$

$IS_i(t)=IO_i*IC_i(t)$

$BS_i(t)=BO_i*BC_i(t)$

Promotion Rate

$$PR_i(t)=PC_i(t)/12 \qquad i>3,\ t=2,\ldots,T \qquad \text{(eqn 3.3)}$$

List Duration

$$LD_i(t)=LS_i(t)/PR_i(\tau) \qquad i>3,\ t=1,\ldots,T;\ \tau=2,3,\ldots \qquad \text{(eqn 3.4)}$$

List Remaining

$$LR_i(1)=LS_i(1) \qquad i>3 \qquad \text{(eqn 3.5)}$$

$$LR_i(t)=\max(LR_i(t-1)+LS_i(t)-PC_i(t),0)) \qquad i>3,\ t=2,\ldots,T \qquad \text{(eqn 3.6)}$$

AFCS

$$CSY_i(t)=CSY_i(t-1)+((LD_i(t)-12)/12) \qquad i>3,\ t=2,\ldots,T \qquad \text{(eqn 3.7)}$$

3. Promotion Inputs

Promotion Flow Inputs

Projected Flows

$L_i(t)$ $\qquad i>3,\ t=2,\ldots,T$

$D_i(t)$ $\qquad i>3,\ t=2,\ldots,T$

$P_i(t)$ $\qquad i=6,\ t=2,\ldots,T$

Promotion List Inputs

Inventory Projections

$AC_i(t)$	i>3, t=1,...,6
$AS_i(1)$	i>3
$IC_i(t)$	i>3, t=1,...,6
$IS_i(1)$	i>3
$BC_i(t)$	i>3, t=1,...,6
$BS_i(1)$	i>3

Previous List Data

$LR_i(1)$	i>3
$CSY_i(1)$	i>3
$CSM_i(1)$	i>3

Promotion Opportunities

AO_i	i>3
IO_i	i>3
BO_i	i>3

4. Input Data Sources

A consolidation of the input data sources is given in Table 6 for i=4,5,6. There are three sources of data which must be input into the promotion model. Two of the sources are the OFIP and promotions branch. COL promotions and promotion opportunities are listed as MILPERCEN projections based on historical records, or educated guesses.

The procedures for implementing the promotion model are to gather the input data and then calculate the promotion variables. These procedures will be explained in detail in the following sections.

B. CALCULATING THE OUTPUT VARIABLES

Once the data is ready for input into the promotion model, the promotion equations are successively computed for each variable until the promotion forecast is complete. Calculations start with t=2 (FY85), as all the values for

TABLE 6

INPUT DATA AND SOURCE

Variables	Description	Source
$AS_i(1)$, $IS_i(1)$, $BS_i(1)$	No. Selected	Pro. Branch
$LR_i(1)$, $CSY_i(1)$, $CSM_i(1)$	Previous Lists	Pro. Branch
$AC_i(1)$, $IC_i(1)$, $BC_i(1)$	No. Considered	OFIP
$L_i(t)$	Losses	OFIP
$D_i(t)$	Delta	OFIP
$P_6(t)$	COL Promotions	Projection
AO_i, IO_i, BO_i	Opportunity	Projection

t=1 are known, and are completed when t=7 on all of the output variables. The promotion equations which require further descriptions are listed below.

1. Promotion Capability

The measure of the total number of officers who will be promoted from a promotion list to the next higher rank is PC for all i and t. In Equation 3.1, PC is an estimate of the vacancies expected at rank i for the time period t. As COL promotions is an input to the model, COL PC is calculated first for t=2,...,T. The remaining ranks are then determined by promoting in the system to fill vacancies.

2. Promotions

The number of promotions for i=4,5 are known once the PC for the next higher rank is specified. The equation for i>3 and t=2,...,T is given as Equation 3.2. The procedure then is to first assign $PC_6(2)=P_5(2)$, then calculate $PC_5(2)$. This process is continued down the ranks and across the time periods until the forecast is completed. This

method insures that only the vacancies expected at the next higher rank are filled.

3. List Size

The first calculations performed for the promotion lists are determining the list sizes. These are performed for each rank i with four equations. The first equation assigns the previous list remaining as the first list to exhaust. The second equation assigns the current list as the next list to exhaust. The final two equations use the inventory projections to set up the remaining lists of the forecast for t=2,...,6.

$$LS_i(1)=LR_i(1)$$

$$LS_i(2)=AS_i(1)+IS_i(1)+BS_i(1)$$

$$LS_i(t+1)=AS_i(t)+IS_i(t)+BS_i(t)$$

$$LS_i(t+1)=AO_i*AC_i(t)+IO_i*IC_i(t)+BO_i*BC_i(t)$$

The time index shows that LS is indexed by the time period following the promotion boards, where AS, IS and BS are board results from the previous time periods. The only unknowns in these equations are the numbers for BS.

To insure that the BO constraint is met, BS is calculated after AS and IS are known. The equations for all i and t combine AS and IS to form the variable AIS. Both AIS and BS are then rounded down using the equations:

$$BS_i(t)=(AS_i(t)+IS_i(t))*BO_i(t)/(1-BO_i)$$

$$BS_i(t)=AIS_i(t)*BO_i(t)/(1-BO_i)$$

LS can then be calculated for all the ranks and for all the years of the forecast.

$LS_4(3)$ is referred to in many ways by MILPERCEN. It can be referred to as the MAJ list size for BY85, PY86, or the YG75 list. The PY convention for identifying the promotion lists is followed by the promotion model. This means that $LS_4(3)$ is the MAJ list for t=3, or PY86.

Using the inventory projections for MAJ in FY85 (t=2), the model produces the following result:

$AIS_4(2)=AC_4(2)*AO_4+IC_4(2)*IO_4$

$AIS_4(2)=775*.19 + 2158*.75 = 1765.75 = 1766$

$BS_4(2) = AIS_4(2)*BO_4/ (1-BO_4)$

$BS_4(2) = 1766*.05 / (1-.05) = 92.95 = 92$

$LS_4(3) = 1766 + 92 = 1858$

4. Promotion Rate

The promotion rate PR is the rate at which officers are promoted from promotion lists. The equation used for i=4,5,6 and t=2,...,T is Equation 3.3. This equation assumes that promotions will be equally spaced out over a 12 month period. PR is FY specific in that it may be applied to more than one promotion list and is recalculated at the start of each time period t.

5. List Duration

The calculations for LD are the primary means to identify if the promotion timing guidance is being met. The equation used for i=4,5,6 and t=1,...,T is equation 3.4. In this equation, τ is used because the PR may not be in the same time period as t. LD refers to the elapsed time from the time a promotion list starts, until it is exhausted. Since promotion lists may span more than one time period, different PRs may be applied to the same list. A list may then start many months after being formed, as all previous lists must first be exhausted. The mechanics of exhausting lists and applying the proper promotion rate can be found in Appendix C in a flowchart format. This consists of exhausting one list at a time and then adding up the cumulative months used to exhaust each list.

If promotion lists are repeatedly longer than 12 months, a backlog develops causing lists to extend beyond the years of the forecast. As there are no forecasted

inventories for these years, PRs cannot be calculated. This is handled by assuming that $PR(\tau) = PR(T)$ for τ larger than T for all i.

6. Lists Remaining

The equations for LR are equations 3.5 and 3.6 for all i and t. Equation 3.5 states that at the start of time period t=2 (FY85), any lists which are not exhausted are assigned as LR(1). This insures that this list will be exhausted before a new list is started. Equation 3.6 is the general equation, used when one or more lists must be carried forward to the next time period. This equation is also used when all the active lists are completed before the end of a time period. This insures that any new lists for succeeding time periods do not start before that time period starts.

7. Years of Active Federal Commissioned Service

The last major calculation which is performed in the promotion model is the calculation of AFCS. This is measured in terms of CSY and CSM, and is a check on promotion timing. The equation used for i=4,5,6 and t=2,...,T is equation 3.7, calculating CSY as a real number. As CSY(1) and CSM(1) are inputs for all i, and LD has already been calculated, years of AFCS are known for t=2,...,T. The mechanics of converting months to years within the model are shown in Appendix C.

C. CALCULATING INPUT VARIABLES

The main source for the input data used in the promotion model is the Officer Force Implementation Plan (OFIP). The most complicated procedure in the promotion model is in the calculation of the inputs from the OFIP. Because of this, some detail of the OFIP and of these procedures are needed.

For simplicity, the notations of i and t will be omitted if the rank and time period are already specified.

The OFIP is published three times per year by MILPERCEN and gives up-to-date information on current inventory, projected force structure, and specific grade data. The OFIP also incorporates DOPMA constraints in terms of budgeted end strength requirements. Through simulation means, the OFIP then projects the OPMD officer corps seven years into the future. All of the numbers extracted from the OFIP are only projections based on the logic and assumptions of the program.

1. Calculating the Promotion Flow Inputs

The primary flow calculation determines the promotion capability to each rank. Equation 3.1 requires $P_6(t)$, and L and D for i>3 and t=2,...,T as inputs. L and D are extracted from the OFIP, while $P_6(t)$ is input as a value projected by MILPERCEN based on previous board results. The methods used to gather this data are summarized for each input one at a time.

a. Loss Data

The first set of forecasted data to obtain from the OFIP is required losses L. These are extracted from within the sections labeled 'FY Projections' from tables labeled as 'Loss Requirements by Grade and YOS' for each fiscal year of the projection. These tables represent the number of officers from each grade that must be removed from the Army during a FY in order to meet DOPMA constraints, based on the OFIP logic. It is attrition data which is the sum of all natural attritions (deaths, retirements, separations ...) and forced attritions which must be achieved in order for the DOPMA constraints to be met. As required losses are OFIP projections, these losses may be achieved

and the constraints of DOPMA may still be violated. Actual losses may differ greatly from required losses, as there are no real measures taken at MILPERCEN to insure required losses are achieved. As such, 'required losses' is a term which is somewhat of a misnomer. These numbers are extracted from the OFIP and shown in Table 7. COL loss data from the OFIP includes promotions of 50 per year to General as these promotions are losses to the OPMD system. The data is then extracted from tables in the OFIP on pages E-5, F-5, G-5, H-5, I-5, and J-5, corresponding to FY85 through FY90 [Ref. 9].

TABLE 7
LOSS REQUIREMENTS BY GRADE

FY	1985	1986	1987	1988	1989	1990
$L_6(t)$	559	425	487	484	491	476
$L_5(t)$	890	918	1149	1145	1165	1213
$L_4(t)$	641	628	656	636	603	573
t	(2)	(3)	(4)	(5)	(6)	(7)

b. End Strength Changes

The second major input from the OFIP is changes in each rank to the total budgeted end strength from year to year. These are also referred to as DOPMA delta figures D, as only the net change in end strength is shown. These occur as Congress adjusts each rank to allow for structural changes within the Army. This data is retrieved from the OFIP under the section labeled 'OFIP Constraints, POM Budget

(Jul 84)' [Ref. 9: p.A-3]. As these projections are only reliable for two years, based on MILPERCEN guidance, D is assumed to be zero from the third year on. A minus number means that a decrease in the number authorized at that rank occurs, and a positive number indicates a rank size increase. Table 8 consolidates these projections from the OFIP.

TABLE 8

END STRENGTH CHANGES TO EACH GRADE

FY	1985	1986	1987	1988	1989	1990
$D_6(t)$	-166	60	0	0	0	0
$D_5(t)$	123	41	0	0	0	0
$D_4(t)$	160	146	0	0	0	0
t	(2)	(3)	(4)	(5)	(6)	(7)

c. Promotions from the COL Rank

The last input required to calculate the promotion flow variables are the values for $P_6(t)$ for t =2,...,T. Force planners at MILPERCEN have analyzed previous promotion board results and have concluded that an average promotion rate from COL is 50/FY.

2. Calculating the Promotion List Inputs

The second set of inputs to the promotion model are inventory projections, current list data, and the promotion opportunities. These inputs allow the calculation of the promotion list variables. Each of these inputs will again be discussed one at a time.

a. Calculating Inventory by Rank

Another major data input needed in the promotion model is the number of officers to be considered for promotion in the IZ and AZ promotion categories. The tables used for projecting the numbers in the promotion categories come from the 'Fiscal Year Projections' sections of the OFIP in tables labeled 'End FY Inventory by YG and Grade'. The actual numbers are extracted from the tables using the promotion windows. Hand calculations are then made and the data is ready for input into the model. The method of extracting the data is different for each rank, requiring each to be discussed separately.

(1) MAJ Inventories. The aim of this section is to demonstrate how MILPERCEN calculates the forecasted number of officers to be considered for promotion in the IZ and AZ categories. This will first be demonstrated for CPTs considered for promotion to MAJ from the IZ ,or $IC_4(t)$. Once these calculations are made, the forecasted number of CPTs considered for promotion to MAJ from the AZ, $AC_4(t)$ will also be demonstrated.

As the promotion window for CPT is set at 10 +/- 1 yr, the IZ YG for consideration for promotion to MAJ is the BY - 10. A practical problem arises in that the OFIP projects FY end strengths, and promotion boards are usually held before the end of the FY. This problem in difference of timing is accounted for by also adding in MAJs in the IZ YG as shown below.

Table 9 lists those officers from the 'End FY 85 Inventory' needed to calculate $IC_4(t)$ [Ref. 9: p.E2]. In Table 9, for BY1985 the CPT IZ YG is 1975. The number of projected CPTs to be considered for promotion to MAJ in the PZ then is:

$$IC_4(2) = 2150 + 8 = 2158$$

This procedure is followed for the other FYs in order to calculate the values for $IC_4(t)$ for t=3,...,6.

TABLE 9

END FY 85 INVENTORY

YRGP	CPT	MAJ
76	2699	0
75	2150	8
74	448	1640
73	97	1719
72	42	1696
71	22	1897
70	4	2423

The number of CPTs considered for promotion to MAJ in the AZ, $AC_4(t)$ cannot be calculated from the OFIP tables. A rough approximation would be to sum all of the CPTs in the OFIP whose YG is prior to the IZ YG. This would not include the timing difference, as the OFIP has already projected the promotion of some of these CPTs to MAJ. The actual number used is the sum of the CPTs in the two previous YGs to the IZ YG, plus those selectively continued as CPTs. The number of selectively continued CPTs is provided by the promotions branch at MILPERCEN. All of these CPTs are included as DOPMA explicitly states that CPTs still on active duty will be considered for promotion until retirement [Ref. 2: pp.38,39].

As seen in Table 9, for BY1985 the two CPT YGs previous to the IZ YG are 1974 and 1973. The number of CPTs selectively continued is 230, as provided by the promotions branch. The number of projected CPTs to be considered for MAJ in the AZ then is:

$$AC_4(2) = 448 + 97 + 230 = 775$$

These procedures are followed for the other FYs in order to calculate the values for $AC_4(t)$ for t=3,...,6.

(2) LTC and COL Inventories. The same basic logic is followed for the ranks of MAJ and LTC, with modifications for the time lag between promotion boards and OFIP accounting procedures. For MAJs, the IZ YG is the board year minus 15 years, where LTCs in the same YG are included in the calculation of the LTC IZ considered $IC_5(t)$. All those MAJs in the two previous YGs and those selectively continued are included in the LTC AZ calculation $AC_5(t)$. Finally, the IZ YG for LTCs is the board year minus 21 years, adjusted for COLs in the same YG for $IC_6(t)$. The two earlier LTC YGs and those selectively continued are included in the COL AZ considered calculation $AC_6(t)$. Promotion backlogs and other timing considerations may cause the procedures outlined above to be modified even further to insure that the OFIP is accurately reflecting inventories at the time of promotion boards.

(3) Consolidated Projected Inventories. Once the time lag has been properly accounted for, and the continuation rates used in the OFIP are acceptable, Table 10 shows the consolidated inventories. BY84 is actual data in this table as reported from board results, which means that BC numbers are also known for this year.

b. Actual Board Results

Actual board results provide data in the form of inventories within promotion windows as shown in Table 10, but they also provide data in the form of actual numbers selected for promotion. These numbers are provided by the promotions branch at MILPERCEN and are shown in Table 11 for BY84 (t=1) by rank. These officers then make up the FY85 (t=2) promotion lists.

TABLE 10

CONSOLIDATED INVENTORIES, FY84-89

FY	1984	1985	1986	1987	1988	1989
$AC_6(t)$	1265	942	917	839	888	141
$IC_6(t)$	991	969	830	1067	1421	1134
$BC_6(t)$	2239	-	-	-	-	-
$AC_5(t)$	1551	1464	1701	1486	1186	902
$IC_5(t)$	2268	2528	1822	1601	1615	1733
$BC_5(t)$	2113	-	-	-	-	-
$AC_4(t)$	708	775	642	649	734	933
$IC_4(t)$	2161	2158	2616	2973	3293	3180
$BC_4(t)$	2282	-	-	-	-	-
t	(1)	(2)	(3)	(4)	(5)	(6)

TABLE 11

ACTUAL 1984 PROMOTION BOARD RESULTS

Rank, i	$AS_i(1)$	$IS_i(1)$	$BS_i(1)$
6	45	485	58
5	239	1609	79
4	144	1686	30

c. Lists Remaining Data

The next data items needed to produce the promotion plan are the promotion lists carried forward to the following FY when they have not been exhausted. The

characteristics needed are the number remaining on that list and the AFCS in years and months of the last due course officer to be promoted from that list. As a new promotion list cannot be started until all previous lists have been exhausted, these numbers form the basis for future calculations. The actual numbers going into FY85 (t=2) are shown in Table 12.

TABLE 12
PREVIOUS LIST DATA FOR START OF FY85

		AFCS	
Rank,i	$LR_i(1)$	$CSY_i(1)$	$CSM_i(1)$
6	124	22	3
5	1372	16	9
4	820	11	4

d. Cumulative Promotion Opportunity

The last of the promotion list inputs are the promotion category opportunities AO_i, IO_i, and BO_i for i=4,5,6. The minimum cumulative promotion constraints were previously listed in Table 5. In order to meet similiar promotion opportunities between YGs, MILPERCEN calculates conditional probabilities of promotion from each promotion category. These probabilities, when summed, just exceed the minimum requirements. This insures that no YG will have less than the DOPMA minimum opportunity for promotion. In order to portray this, the following notation is defined for each rank i>3.

$P(S_i)$=the cumulative probability of being selected

$BO_i=P(BZ_i)$=the probability of being selected from the BZ

$IO_i=P(IZ_i/\overline{BZ}_i)$=the selection probability from the IZ given not selected from the BZ

$AO_i=P(AZ_i/\overline{BZ}_i,\overline{IZ}_i)$=the selection probability in the AZ given not selected from the BZ and IZ

$P(S_i)=P(BZ_i)+P(IZ_i/\overline{BZ}_i)P(\overline{BZ}_i)+P(AZ_i/\overline{BZ}_i,\overline{IZ}_i)P(\overline{IZ}_i/\overline{BZ}_i)P(\overline{BZ}_i)$

From these formulae, promotion opportunities for the AZ and IZ promotion categories are calculated by MILPERCEN and are presented in Table 13 for i=4,5,6.

TABLE 13

PROMOTION OPPORTUNITIES BY RANK

Rank, i	AO_i	IO_i	BO_i
6	.04	.47	.10
5	.13	.67	.10
4	.19	.75	.05

The percentages selected from the BZ category are calculated once the AZ and IZ numbers are known. As DOPMA constrains the BZ percentages to a maximum percentage of the total list, the number calculated is always rounded down to insure compliance with this constraint. The promotion model makes the assumption that the maximum percentage allowed from the BZ are selected as shown in Table 13.

These promotion opportunities permit the same opportunity for each YG coming into the promotion window and insure that the cumulative promotion opportunity constraint is satisfied. These opportunities are then fixed for all years of the forecast for all the ranks.

EXAMPLE: For MAJ, the cumulative opportunity for promotion $P(S_4)$ is equal to:

$$P(S_4)=P(BZ_4)+P(IZ_4/\overline{BZ}_4)P(\overline{BZ}_4)+P(AZ_4/\overline{BZ}_4,\overline{IZ}_4)P(\overline{IZ}_4/\overline{BZ}_4)P(\overline{BZ}_4)$$

$$P(S_4)=BO_4+IO_4(1-BO_4)+AO_4(1-IO_4)(1-BO_4)$$

$$P(S_4)=.05+(.75)(.95)+(.19)(.25)(.95)$$

$$P(S_4)=.8076$$

This insures a cumulative promotion opportunity greater than the 80% as set forth in DOPMA.

3. Consolidated Inputs

As can be seen by the previous sections, the data input requirements for the promotion model are quite extensive. Table 14 lists all the input parameters and actual values used in the promotion model.

D. MODELLING ASSUMPTIONS

The previous paragraphs have explained the development of a model which is hierarchial, and for which promotion projections are made based on the number of vacancies expected at each grade. This method has remained relatively intact at MILPERCEN in terms of logic and computational procedures over the past few years. The only major improvement has been the automation of the promotion plan using Lotus 1-2-3 in December 1984. A major concern has been the exceedingly long promotion list durations which have occurred at all ranks. This has caused officers to be promoted later than the upper bound of the promotion windows, as expressed in Table 4. While the accumulation of a set of 'rules of thumb' and 'best guesses' have been incorporated into the input data, a closer look at each of these assumptions is needed in order to clarify where improvements can be made.

TABLE 14

CONSOLIDATED INPUTS TO THE PROMOTION MODEL

FY	84	85	86	87	88	89	90
Losses							
$L_6(t)$	-	559	425	487	484	491	476
$L_5(t)$	-	890	918	1149	1145	1165	1213
$L_4(t)$	-	641	628	656	636	603	573
Delta							
$D_6(t)$	-	-166	60	0	0	0	0
$D_5(t)$	-	123	41	0	0	0	0
$D_4(t)$	-	160	146	0	0	0	0
Projected Inv.							
$AC_6(t)$	1265	942	917	839	888	141	-
$IC_6(t)$	991	969	830	1067	1421	1134	-
$BC_6(t)$	2239	-	-	-	-	-	-
$AC_5(t)$	1551	1464	1701	1486	1186	902	-
$IC_5(t)$	2268	2528	1822	1601	1615	1733	-
$BC_5(t)$	2113	-	-	-	-	-	-
$AC_4(t)$	708	775	642	649	734	993	-
$IC_4(t)$	2161	2158	2616	2973	3293	3180	-
$BC_4(t)$	2282	-	-	-	-	-	-
t	(1)	(2)	(3)	(4)	(5)	(6)	(7)

Previous Lists

i	$AS_i(1)$	$IS_i(1)$	$BS_i(1)$	$LR_i(1)$	$CSY_i(1)$	$CSM_i(1)$
6	45	485	58	124	22	3
5	239	1609	79	1372	16	9
4	144	1686	30	820	11	4

Promotion Opportunities

i	AO_i	IO_i	BO_i
6	.04	.47	.10
5	.13	.67	.10
4	.19	.75	.05

1. Required Losses

Required losses are input into the promotion model from the OFIP and have been explained as a target that MILPERCEN tries to achieve in a FY. How these numbers are actually calculated within the OFIP is beyond the scope of this thesis, but the importance of the accuracy of these numbers cannot be discounted. This importance can be seen in the promotion capability calculations.

As an example, take COL projections for FY1985, where the total PC was calculated as 443, and L was projected at 559. P and D for i=6 and t=2 were projected as 50 and -166 respectively. In this year, the major source of PC is in the assumption for the value of L.

2. COL Promotions

The second major assumption used is that $P_6(t)$ will be set at 50 per year. The effect on PC of not getting the COL promotions of 50 will be smaller than not getting the L values. Promotions to COL are usually very close to 50/FY so that the actual variations will not have a large impact on the PC.

3. DOPMA Changes

MILPERCEN assumes that changes in the grade sizes D, as reflected in the OFIP, are accurate for only the first two years of the forecast. It is further assumed that no grade size changes will occur for the remainder of the forecast years. This assumption would be critical if reductions occur at the upper grades after t=3. This type of change would have the most effect on all the ranks, as the reductions would be passsed down to the lower ranks.

4. Promotion Opportunity

A somewhat arbitrary set of promotion opportunities have been set for each grade. These insure equal promotion

opportunity between YGs within a grade, and also insure that minimum cumulative promotion opportunities are exceeded. It is known that far fewer officers are selected from the BZ category than the maximum percentages used as inputs in the current model. This may have a significant impact on the promotion plans based upon cohort sizes as they enter the different promotion zones.

5. Constraint Priorities

In constructing this model, MILPERCEN planners have assumed that particular DOPMA constraints have absolute priority over others. In particular, the following constraints are arranged by priority:

a) Meeting budgeted end strength exactly.
b) Insuring equal cumulative promotion opportunity between cohorts of a particular grade.
c) Insuring each cohort receives a cumulative promotion opportunity which is greater than the minimum opportunities set by DOPMA.

By making these assumptions, the promotion model produces a system characterized by three main factors:

a) Long promotion list durations.
b) Promotion points which are outside the windows set by DOPMA.
c) Long durations of time where officers are sitting on promotion lists before previous lists are exhausted.

The rationale for these assumptions is that officers would prefer to be in a promotable status on a promotion list, rather than have promotion boards delayed.

E. CURRENT IMPLEMENTATION USING MICROPLAN

The promotion model is currently implemented using the Lotus 1-2-3 system on a microcomputer. The input data is entered into appropriate cells within the program, and the

promotion plans are generated for each rank. The step-by-step procedures of implementing this package can be found in [Ref. 2]. The main purpose of this discussion will be to demonstrate some of the capabilities of the Microplan, and then emphasize some of its limitations.

1. Generating Promotion Plans

Using Microplan, the input data is entered one cell at a time into labeled areas. The Lotus program updates the entries during this process using the row or column addition features. Simple code is then utilized to produce the output variables and arrange the promotion plan in another block of cells. Running the Microplan in this manner does generate the original promotion plan very quickly, as compared to the manual spreadsheet.

2. Running Microplan Again

Incorrect results are obtained if the Microplan is run again. This deficiency will be demonstrated by varying the assumption on the values for $L_6(t)$. The input data is changed so that the assumption is that COL losses are 50% less for t=2,...,T. The resulting values for $L_6(t)$ and $LD_6(t)$ for t=2,...,T are shown in Table 15. A quick manual computation shows that $LD_6(2)$, or the LD for YG63, should equal 24 months, not the 30 months which is calculated using Microplan.

F. SUMMARY OF THE MICROPLAN

The current implementation of the promotion model is not adequate for the needs of the force planners at MILPERCEN. Small errors, as shown in the last section, do not by themselves justify a new implementation of the promotion model. The Microplan model is not being used for doing 'what if?' drills at MILPERERCEN for a number of other reasons though.

TABLE 15
COL REQUIRED LOSSES AT 50% OF THE ORIGINAL

FY	1985	1986	1987	1988	1989	1990
$L_6(t)$	280	213	244	242	246	238
$LD_6(t)$	30	22	20	25	31	27
t	(2)	(3)	(4)	(5)	(6)	(7)

The following conclusions on the Microplan model do justify a new implementation. The conclusions by force planners at MILPERCEN are that the Microplan:

1. Does not generate correct results without having to turn the model off, reenter new data, and then execute the model again.
2. Is not responsive to large changes in the input data, as it quickly exceeds the variable arrays.

For these reasons, and many others, the Microplan is not being used at MILPERCEN. A more flexible, responsive, and accurate implementation of the promotion model is provided in the next chapter.

G. SUMMARY OF THE PROMOTION MODEL

The formulation of the promotion model is in terms of ordered computations. The input data requirements are quite extensive and difficult to gather. Once the data is consolidated and input into the promotion model, a set of dependent flow and list variables are calculated. These variables are then organized into the five year promotion plan, which MILPERCEN publishes as a forecast for the promotion system.

IV. PROPOSED PROMOTION FLOW MODEL PROPLAN

A. ORGANIZATION OF THE PROPLAN

A computer flow model which initially uses the same input assumptions that the Microplan uses will now be presented. Proplan is written in fortran code (WATFIV), and is written to be executed on an IBM 3033 mainframe. The actual computer code can be found at Appendix B. Proplan is also written in a modular design containing a main program and two subroutines. Explanatory comment statements are found throughout the program to help explain the logic of the program. As a further aid, flow charts for this program can be found at Appendix C.

B. PROPLAN INPUT FILES

Proplan accepts data input from three input data files. The organization of these three files is shown in Appendix D. This appendix shows the files with file, column, and row headings added for clarity. The actual files used for data input only contain the numbers shown with no blank lines between the input categories.

To further explain the input data files, the characteristics of each file are outlined below. Each file is identified by a filename (fn), filetype (ft), and filemode (fm). The (fm) is optional in most cases, and will only be used as needed. The (fn) of each of these three files is 'FILE', and the (ft) is 'FT10F001', 'FT11F001', and 'FT12F001'. These will be referred to as File 10, File 11, and File 12, or as the first, second, and third input files. The mechanics of setting up the input files to execute the model will be explained in more detail as Proplan is demonstrated.

Appendix D shows the input files containing the following data:

1. File 10 contains losses and end strength changes for all ranks, and the inventory projections for the three promotion categories.
2. File 11 contains the projected COL promotions, the actual board results from BY1984 (shown as FY1985 list data), and the previous lists data.
3. File 12 contains the promotion opportunities for all the ranks.

C. CAPABILITIES OF PROPLAN

The Proplan model, though similiar in logic to the Microplan, improves the analytical capabilities of the force planner at MILPERCEN. The capabilities of the Proplan can briefly be explained in the following manner. Proplan was developed to:

1. Utilize the speed, flexibility, and graphical capabilities of the mainframe.
2. Present the plan in a computer language which is understood and is more accessible to a greater number of analysts.
3. Provide flexibility in data input through the use of files and interactive changes to the input files.
4. Further increase the flexibility of the plan through the use of 'exec' programs and subroutines.
5. Provide a model which is capable of handling large variations in the input variables during the sensitivity drills.
6. Provide an interactive model which can be exercised and understood by decision makers with some understanding of Fortran.

This is only a short listing of some of the added capabilities of the Proplan model. Many of these capabilities will be demonstrated during the execution of the model. The important point is that the Proplan is versatile enough to handle a wide variety of added features. As an example of this capability, Proplan is called as a subroutine by an exec program in the next section. This gives Proplan the capability to accomplish much more than only produce a static representation of the promotion plans.

D. PROPLAN EXEC PROGRAMS

The added flexibility of producing the promotion plans using Proplan is now shown using 'Exec 2' (exec) programs [Ref. 10]. The two exec programs furnished with this model are shown in Appendix E. The first program is named 'Trans Exec A1', using the (fn) (ft) (fm) convention. This program allows the user to transfer the output files (promotion plans) to APL for further manipulation and graphing. The second program is named 'Pro Exec A1', and allows the user to interactively execute the model. The Pro exec also has a number of other capabilities, and will be used extensively to explain the operation of the Proplan.

E. DEMONSTRATION OF THE PROPLAN

Proplan is currently set up to read input data from File 10, File 11, and File 12. To execute Proplan, the requirement is to type in the following files:

1. Proplan Watfiv A1
2. Pro Exec A1
3. Trans Exec A1
4. File FT10F001 A1
5. File FT11F001 A1
6. File FT12F001 A1

The spacing and order of the input files are very critical, as Proplan uses fixed format 'READ' statements for data input. The setup is as shown in Appendix D, but with the alphanumeric headings removed. The first number in each category of input is offset to aid in the input of the data and identification of the major categories. A user familiar with Fortran should be able to locate the first READ statement for each file and position the first set of numbers. All other input numbers can then be entered as shown in Appendix D.

Once the input files and other programs are typed in, the model is executed by entering the following command:

'PRO'

This starts the exec program named Pro, and the remainder of the program is executed interactively.

1. Generating the Initial Promotion Plans

A sample execution of Proplan will now be demonstrated to generate the promotion plans. These are the promotion plans which show a static picture of the promotion situation using the assumptions of Chapter 3. The issuing of the 'Pro' command, and the further commands to produce these promotion plans are shown in Figure 4.1.

The response requirements within the Pro exec will now be further explained, using Figure 4.1 as a reference. The first set of requirements is to specify the program to be executed and the input data files. The program executed is identified by 'Proplan Watfiv'. Each of the input files is identified by the (fn) of 'FILE'. As will be shown later, the input files may be renamed with a different (fn) for the sensitivity drills. The (ft) for the input files are set as FT10F001, FT11F001, and FT12F001 automatically. The (fm) is also automatically set as A1 for all the input data files. Neither the (ft) or the (fm) may be changed at any time within the Pro exec.

```
*enter the command 'Pro' to initialize the exec

pro

PROVIDE (FN) (FT) (FM) OF PROGRAM TO BE EXECUTED

proplan watfiv

SPECIFY THE (FN) FOR THE
FIRST INPUT DATA FILE:
file

SPECIFY THE (FN) FOR THE
SECOND INPUT DATA FILE:
file

SPECIFY THE (FN) FOR THE
THIRD INPUT DATA FILE:
file

SPECIFY THE TARGET DATA FILES FOR OUTPUT
THE (FT) AND (FM) ARE SET AS 'DATA A1'
USE ANY AUTHORIZED (FN) FOR EACH PLAN

SPECIFY THE (FN) FOR THE COL PROMOTION
PLAN, USE A (FN) SUCH AS 'CX...'

c1

SPECIFY THE (FN) FOR THE LTC PROMOTION
PLAN, USE A (FN) SUCH AS 'LX...'

l1

SPECIFY THE (FN) FOR THE MAJ PROMOTION
PLAN, USE A (FN) SUCH AS 'MX...'

m1

WOULD YOU LIKE TO COMPILE A NEW PROGRAM?
ENTER 0-NO, 1-YES
1

You will be linked to the WATFIV virtual machine
at virtual address 120 and at mode B for the
execution of your WATFIV program.

ENTER THE CURRENT BOARD YEAR:
84

STATEMENTS EXECUTED=      761

* You must press 'enter' at this time in
* order to complete the execution of Proplan

DO YOU WANT TO SEE A COPY OF THE LISTING FILE?
ENTER 0-NO, 1-YES
0

*The remaining responses are omitted
```

Figure 4.1 Example of Using the Pro Exec

The second set of requirements is to specify names for the output data files. In this example, 'C1 L1 M1' were the names given to the COL, LTC, and MAJ promotion plans, respectively. This means that the following files will be generated:

a) C1 Data A1
b) L1 Data A1
c) M1 Data A1

These three files are created automatically by the Pro exec, and should look like Figure 4.2, if no errors were made. These three data files show the projected promotion plans for each of the FG ranks. The next response in Figure 4.1 is 'Yes' so that the program will be compiled. The Proplan is then executed, and the only interactive input required by Proplan is in response to the query:

'Enter the current board year'

This is answered by entering 84.

The Proplan is then executed, and 'Enter' must be pressed after execution so that the Pro exec will continue. The remainder of the questions are answered 'No' at this time, as the requirement to generate the initial promotion plans is complete.

2. Layout of the Promotion Plans

The organization of the promotion plans is now described because reference to these plans will be frequently made. Figure 4.2 is actually a consolidation of the three output files named C1, L1, and M1. All three are organized the same, so only 'C1 Data A1' will be explained.

The top one third of Figure 4.2 contains 'C1 Data A1'. The column headings should already be familiar from the promotion model formulation. Column 1 of the plan identifies the promotion lists by the promotion year. A second feature is that AFCS has also been calculated as a real

COL PROM LIST

	BRD YR	YEAR GRP	PROM CAP	LIST SIZE	LIST DURAT	AFCS YRS	AFCS MOS	
PY85	84	63	443	588.0	15	22	6	(22.50)
PY86	85	64	540	547.0	12	22	6	(22.50)
PY87	86	65	537	474.0	11	22	5	(22.42)
PY88	87	66	534	594.0	13	22	6	(22.50)
PY89	88	67	541	781.0	18	23	0	(23.00)
PY90	89	68	526	643.0	15	23	3	(23.25)

LTC PROM LIST

	BRD YR	YEAR GRP	PROM CAP	LIST SIZE	LIST DURAT	AFCS YRS	AFCS MOS	
PY85	84	69	1456	1927.0	15	17	0	(17.00)
PY86	85	70	1499	2093.0	15	17	3	(17.25)
PY87	86	71	1686	1602.0	11	17	2	(17.17)
PY88	87	72	1679	1406.0	10	17	0	(17.00)
PY89	88	73	1706	1373.0	9	16	9	(16.75)
PY90	89	74	1739	1420.0	10	16	7	(16.58)

MAJ PROM LIST

	BRD YR	YEAR GRP	PROM CAP	LIST SIZE	LIST DURAT	AFCS YRS	AFCS MOS	
PY85	84	74	2257	1860.0	10	11	2	(11.17)
PY86	85	75	2273	1858.0	10	11	0	(11.00)
PY87	86	76	2342	2193.0	11	10	11	(10.92)
PY88	87	77	2315	2476.0	13	11	0	(11.00)
PY89	88	78	2309	2746.0	14	11	2	(11.17)
PY90	89	79	2312	2709.0	14	11	4	(11.33)

Figure 4.2 Promotion Plans Using Proplan

number in the last column. This is in addition to the normal representation of AFCS in years and months. All of the other entries are listed under their column headings, so that reading each row will give the characteristics of that promotion list. With this introduction to the Proplan model, a simple exercise showing how to utilize the gaming capabilities of Proplan will be explored in the next section.

F. 'WHAT IF?' CAPABILITY OF THE PROPLAN

One of the most significant improvements of the Proplan over Microplan is in the gaming capabilities of the model. This has been accomplished through the use of data files and the Pro exec program. The same 'what if?' question used in the Microplan will be analyzed using the Proplan. The requirement to change data and execute the model again are all performed interactively with the Pro exec.

In the following example execution of the Proplan, the assumption is that the user has just completed execution of the original promotion plans. The final question in the Pro exec is:

'Do You Want to Run the Model Again?'

Answering this question 'Yes' will lead to another set of questions which will prepare the Proplan model to execute again. The response requirements are shown in Figure 4.3. In Figure 4.3, File 10 is changed so that the first column contains the elements of Table 15 of the previous chapter. The first column of file 10 will then have the COL required losses at 50% of the original. Notice that the (fn) is not changed so that the original input file no longer exists. The lines omitted in Figure 4.3 are questions referring to the other input data files.

The Pro exec is then interactively executed again, changing the ouput target data files to C2, L2, and M2. This creates three output files automatically with the (ft) of 'Data'. These data files can then be compared to the original promotion plans either manually through printouts of the files, or graphically as explained in the next section.

```
DO YOU WANT TO RUN THE MODEL AGAIN?
ENTER 0-NO, 1-YES
1

DO YOU WANT TO CHANGE ANY OF THE
INPUT FILE DATA OR IDENTIFIERS?
ENTER 0-NO, 1-YES
1

DO YOU WANT TO CHANGE THE (FN)
OF THE FIRST INPUT DATA FILE?
ENTER 0-NO, 1-YES
0

DO YOU WANT TO CHANGE ANY DATA
IN THE FIRST INPUT DATA FILE?
ENTER 0-NO, 1-YES
1

YOU MAY NOW CHANGE DATA IN
THE FIRST INPUT DATA FILE:

*** LINES OMITTED ***

PROVIDE (FN) (FT) (FM) OF PROGRAM TO BE EXECUTED
proplan watfiv

SPECIFY THE (FN) FOR THE
FIRST INPUT DATA FILE:

file

SPECIFY THE (FN) FOR THE
SECOND INPUT DATA FILE:

file

SPECIFY THE (FN) FOR THE
THIRD INPUT DATA FILE:

file

SPECIFY THE TARGET DATA FILES FOR OUTPUT
THE (FT) AND (FM) ARE SET AS 'DATA A1'
USE ANY AUTHORIZED (FN) FOR EACH PLAN

SPECIFY THE (FN) FOR THE COL PROMOTION
PLAN USE A (FN) SUCH AS 'CX...'

c2

SPECIFY THE (FN) FOR THE LTC PROMOTION
PLAN USE A (FN) SUCH AS 'LX...'

l2

SPECIFY THE (FN) FOR THE MAJ PROMOTION
PLAN USE A (FN) SUCH AS 'MX...'

m2
```

Figure 4.3 Changing Input Data Using the Pro Exec

G. GRAPHICAL CAPABILITIES USING PROPLAN

One of the most significant capabilities of the Proplan and exec programs is the ability to produce clear and accurate graphics. The enhanced capability to interactively store data, visually compare changes in the plans, and perform sensitivity drills are demonstrated in this section, and in the next chapter.

Output data files were specifically created so that the capabilities of GRAFSTAT, an IBM graphics package could be utilized. GRAFSTAT utilizes simple APL programming statements and offers a wide range of graphing options.

The requirements in order to create a graph are to transfer an output data file to APL, then utilize GRAFSTAT to create plots. In order to do this though, the character elements within the output files must be removed. This is easily done by one of the two methods as follows:

1. Comment out the character generating statements within Proplan and then execute the Pro exec.
2. Edit the output files directly and remove all the character elements.

A variation of the first method is preferred once the user has gained some experience with the Proplan. This requires the user to make a copy of the Proplan, rename the program under a new (fn), and then delete all the character generating statements. This offers the user the ability to repetitively use the Pro and Trans execs without leaving the exec environment. The second method is more direct and should be used when first using the model.

Whichever method is used, the new data files will look like Figure 4.2, with only the numbers remaining. The first column of numbers must start in column 1, with subsequent columns separated by at least one space. For APL purposes, this is a matrix of dimension 6 x 9.

The next step, after setting up files ready for transfer, is to transfer the data to an APL workspace. This is accomplished through the use of the exec titled 'Trans Exec A1', also found in Appendix E. The discussion which follows assumes that the user is not executing the Trans exec from within the Pro exec. This method of interactively and repetitively transferring data using both execs will be demonstrated in the next chapter. To execute the transfer, the command 'Trans' is entered from the CMS environment. The remainder of the transfer operation is performed interactively with the user. An example execution of this program is displayed in Figure 4.4.

Each of the promotion plans is then assigned to an APL variable, and further assigned to an APL workspace. In this example, C1A is the original COL promotion plan and C2A is the COL promotion plan with required losses cut in half. These are both matrices of dimension 6 X 9, and are assigned to an APL workspace named 'PRPLAPL'.

The assigning of the variables in this mannner offers two significant advantages. The first is that many plans can be generated and stored efficiently. The second is that particular variables can be isolated and compared very readily from the different runs.

An example of isolating list durations will be demonstrated. This can be done in two ways:

1. Assign this column of values to a new variable while in APL workspace PRPLAPL.
2. Perform the assignment in GRAFSTAT after transferring the entire workspace to GRAFSTAT.

In this example, two additional variables were created in APL workspace PRPLAPL as follows:

```
C1AD ← C1A [;6]
C2AD ← C2A [;6]
```

```
trans

ENTER THE (FN) AND (FT) OF THE
FILE TO BE TRANSFERRED TO APL:
(FILE MUST BE A NUMERIC FILE)

c1a data

ENTER THE NAME OF THE APL VARIABLE
THAT WILL STORE THIS DATA:

c1a

ENTER THE NAME OF THE APL WS THAT
YOU WANT THE VARIABLE C1A TO BE
STORED IN:
prplapl

IS PRPLAPL A NEW OR AN OLD WORKSPACE?
ENTER 0-OLD, 1-NEW
0

YOUR DATA WILL BE TRANSFERRED
TO APL WS PRPLAPL

DO YOU WANT TO KEEP THE CMS FILE?
ENTER 0-NO, 1-YES
1

*Trans executes, end of 1st execution

trans

ENTER THE (FN) AND (FT) OF THE
FILE TO BE TRANSFERRED TO APL:
(FILE MUST BE A NUMERIC FILE)

c2a data

ENTER THE NAME OF THE APL VARIABLE
THAT WILL STORE THIS DATA:

c2a

ENTER THE NAME OF THE APL WS THAT
YOU WANT THE VARIABLE C2A TO BE
STORED IN:

prplapl

IS PRPLAPL A NEW OR AN OLD WORKSPACE?
ENTER 0-OLD, 1-NEW
0

YOUR DATA WILL BE TRANSFERRED
TO APL WS PRPLAPL

DO YOU WANT TO KEEP THE CMS FILE?
ENTER 0-NO, 1-YES
1
```

Figure 4.4 Example Execution of the Trans Exec

This takes the sixth column (duration) of each matrix and assigns these values to a new variable. The graph created using GRAFSTAT is shown in Figure 4.5 utilizing the PLOT function. Transferring entire matrices to GRAFSTAT based on different assumptions can significantly improve the analysis capabilities of the promotion plan. The resulting effect can also be shown on the AFCS, which is a cumulative effect. This can be seen in Figure 4.6, which was produced by creating two other variables in APL workspace PRPLAPL as follows:

$$C1AAF \leftarrow C1A\ [;9]$$

$$C2AAF \leftarrow C2A\ [;9]$$

This takes the ninth column (AFCS) of each matrix and assigns these values to the new variables. The effect of the longer list durations is more evident in Figure 4.6, as the promotion point of 23 years for COL is clearly being violated.

H. SUMMARY OF PROPLAN

The Proplan implementation of the promotion model quickly and accurately produces the promotion plan. The additional features of executing Proplan using exec programs have been demonstrated to show some of the flexibility offered by using a fortran based implementation. Using graphics packages and the procedures for implementing new input assumptions allows the user to analyze changes in the promotion system. Proplan is a superior implementation of the promotion model, as compared to Microplan, which will be demonstrated in more detail in the following chapter.

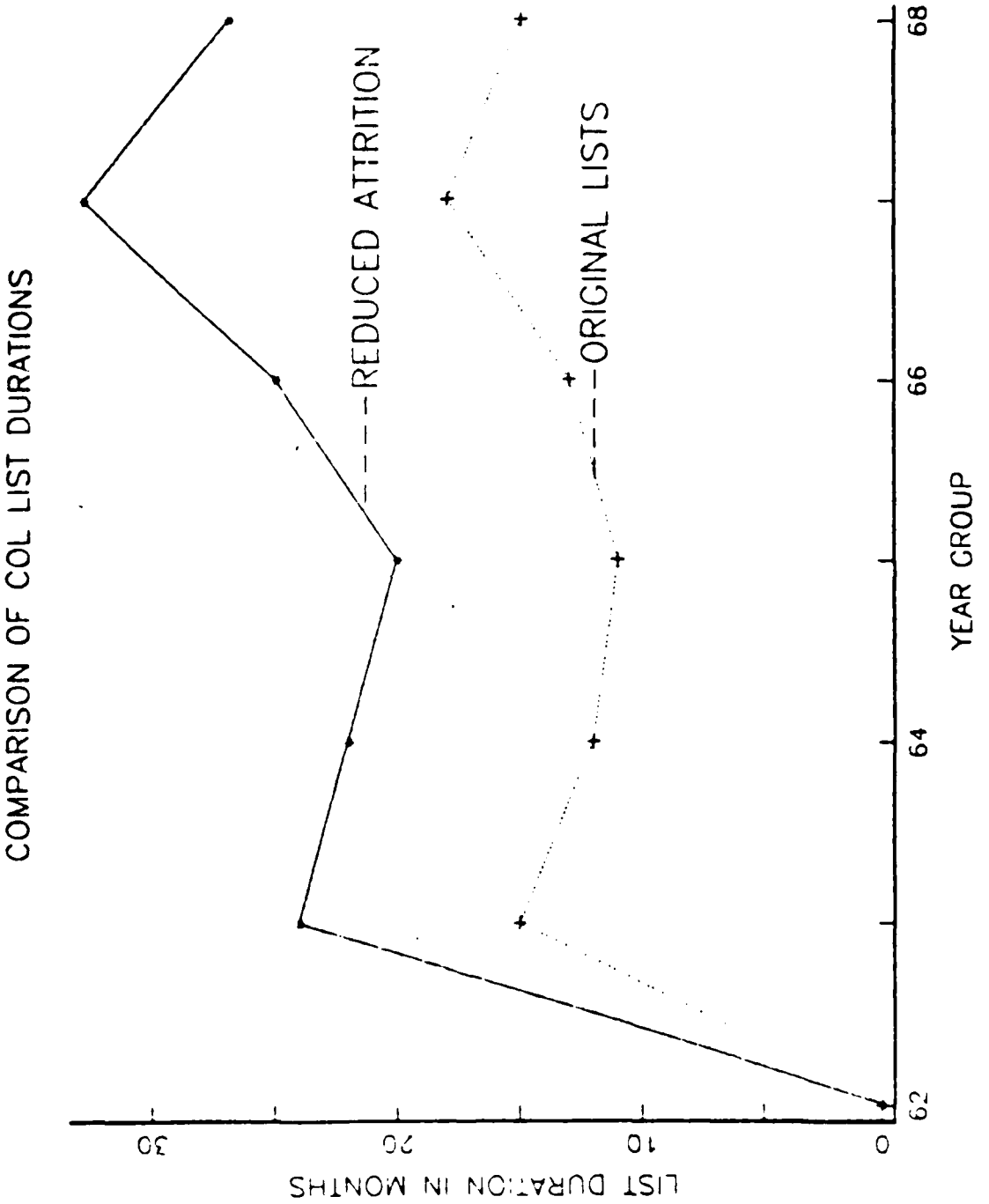


Figure 4.5 Comparison of COL List Durations Using Grafstat

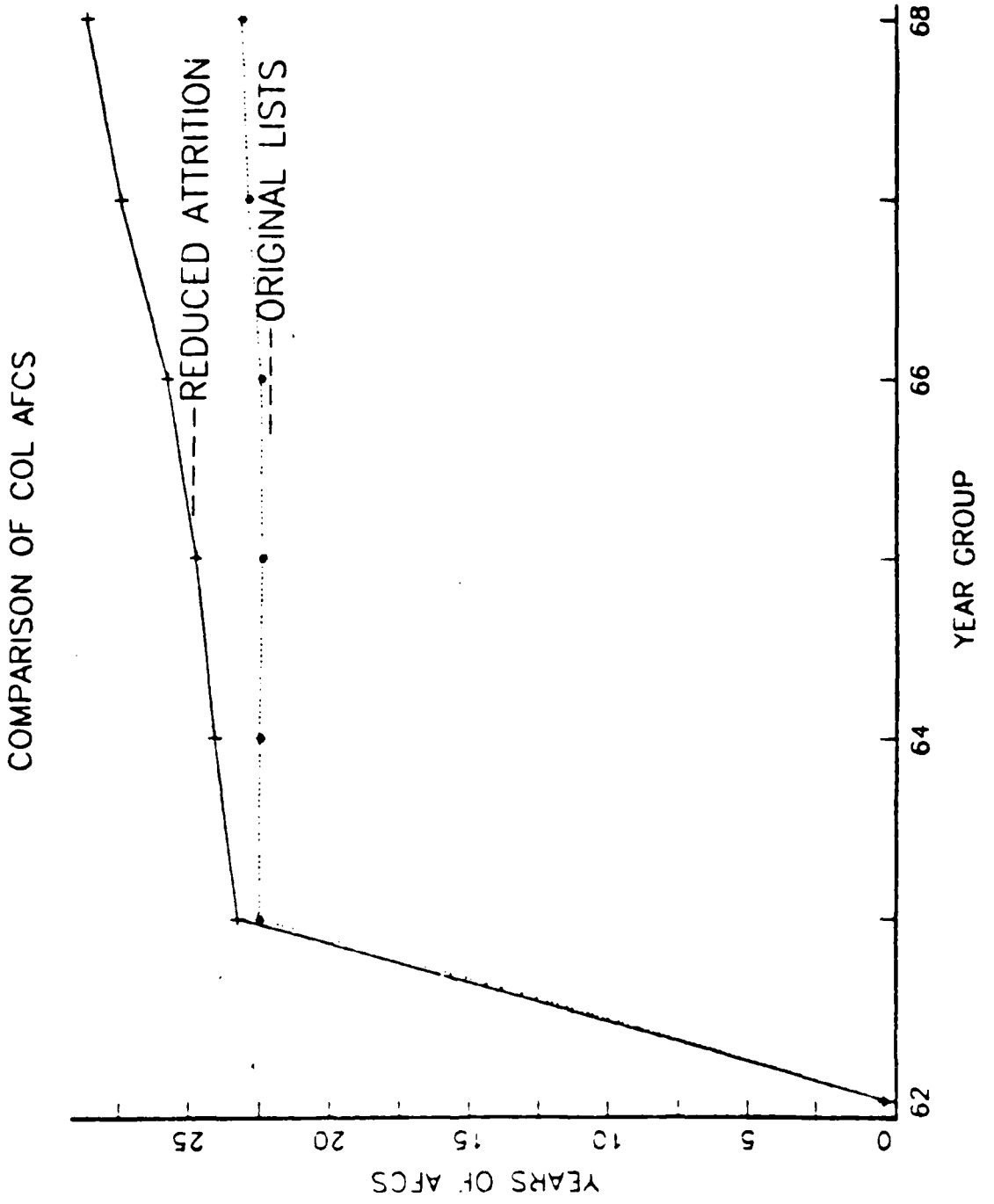


Figure 4.6 Comparison of COL AFCS Using Grafstat

V. TYPICAL EXERCISES USING THE PROPLAN MODEL

In this chapter, the enhanced capabilities of the Proplan model to perform sensitivity analysis will be demonstrated. This will require developing more precise definitions of the objectives of the promotion system. A method to perform tradeoff analysis will also need to be developed by using Proplan and the computer exec programs. Emphasis throughout will be on the mechanics of using Proplan and the exec programs to perform typical MILPERCEN sensitivity tests. First, two recently completed projects at MILPERCEN will be repeated using the Proplan. The methodology for completing a very specific tradeoff analysis of two competing objectives will then be developed. This will be demonstrated using losses and list durations as a final exercise for the Proplan. The requirements of using the Pro exec and Proplan together increases in complexity as the analysis within this chapter proceeds.

A. OBJECTIVES OF THE PROMOTION SYSTEM

Force planners at MILPERCEN manage the promotion system with three major objectives in mind. These are to:

1. Exactly meet the budgeted end strengths for each grade at the fiscal year end.
2. Insure that each officer receives at least the minimum cumulative opportunity for promotion to each rank.
3. Promote officers to each rank within the promotion windows as set by DOPMA.

While these are the primary objectives of the promotion system, there exist a number of other secondary objectives. These additional objectives are imposed in order to provide

consistency to the promotion system from one year to the next. The three most important of these are that:

1. The system should provide relatively similiar promotion opportunities to each rank over a five year period.
2. Promotion lists may not contain more than a certain percentage of officers from the BZ category.
3. The system would prefer to complete promotion lists in the promotion year immediately after the board year.

These objectives are only guidelines and may be relaxed if needed. The end strength objective is the most critical because of its relationship to the budget, but even the end strengths can be evened out between the competitive categories within the Army as a whole.

B. CURRENT PROMOTION PLAN CHARACTERISTICS

The original promotion plan is reintroduced in this section so that a closer look can be taken at its characteristics. Figure 5.1 shows the original promotion plan as developed in Chapter 4.

The main characteristics of interest for the planners at MILPERCEN are the promotion capability PC, the list duration LD, and the promotion timing as measured by AFCS. PC has already been explained as a measure of the total number of vacancies which are expected at the next higher rank. Comparison of PC and list size LS also gives the force planner a feeling for how much the system is going to back up. A second measure for the degree of stagnation within the system is LD. LDs which are consistently greater than twelve months are a sure sign of promotion timing problems. Long LDs ultimately affect the AFCS (promotion timing), as AFCS is a cumulative measure of how well the system is promoting officers.

COL PROM LIST

	BRD YR	YEAR GRP	PROM CAP	LIST SIZE	LIST DURAT	AFCS YRS	AFCS MOS	
PY85	84	63	443	588.0	15	22	6	(22.50)
PY86	85	64	540	547.0	12	22	6	(22.50)
PY87	86	65	537	474.0	11	22	5	(22.42)
PY88	87	66	534	594.0	13	22	6	(22.50)
PY89	88	67	541	781.0	18	23	0	(23.00)
PY90	89	68	526	643.0	15	23	3	(23.25)

LTC PROM LIST

	BRD YR	YEAR GRP	PROM CAP	LIST SIZE	LIST DURAT	AFCS YRS	AFCS MOS	
PY85	84	69	1456	1927.0	15	17	0	(17.00)
PY86	85	70	1499	2093.0	15	17	3	(17.25)
PY87	86	71	1686	1602.0	11	17	2	(17.17)
PY88	87	72	1679	1406.0	10	17	0	(17.00)
PY89	88	73	1706	1373.0	9	16	9	(16.75)
PY90	89	74	1739	1420.0	10	16	7	(16.58)

MAJ PROM LIST

	BRD YR	YEAR GRP	PROM CAP	LIST SIZE	LIST DURAT	AFCS YRS	AFCS MOS	
PY85	84	74	2257	1860.0	10	11	2	(11.17)
PY86	85	75	2273	1858.0	10	11	0	(11.00)
PY87	86	76	2342	2193.0	11	10	11	(10.92)
PY88	87	77	2315	2476.0	13	11	0	(11.00)
PY89	88	78	2309	2746.0	14	11	2	(11.17)
PY90	89	79	2312	2709.0	14	11	4	(11.33)

Figure 5.1 Current Promotion Plan Characteristics

Referring to Figure 5.1 again, the effect of continuing current promotion practices is most dramatic in the promotion 'out' years. These are the later years of the forecast. The most dramatic effect is shown on the COL promotion lists. By the out years, LS is consistently greater than PC, LD is typically greater than 12 months, and AFCS has exceeded the upper bound of 23 years. A similiar effect is shown for the other lists, except for LTC in the out years.

The most natural question to ask at this time is 'what can be done about these long list durations?', assuming that violating the AFCS guideline is a real concern. The answer

requires a model like the Proplan so that a range of options can be offerred to the decision maker. This same question will be referred to again once the methodology for answering this question using Proplan is more completely developed.

C. PROMOTION SYSTEM TRADEOFF DESCRIPTION

Now that the objectives of the promotion system have been presented, and the current plan has been characterized, a means to tradeoff the conflicting objectives needs to be developed.

The main conflicting variables of the promotion system are in the promotion opportunity, the promotion capability, and the promotion timing. These are the promotion variables which will be used for the sensitivity exercises. The current plan offers a relatively stable promotion opportunity for all YGs coming into the promotion window. This causes large promotion lists if such a YG has not been attrited to an 'expected' size. At the same time, PC may be smaller than expected because of less attrition at the next higher rank. The end result is long LDs, which then cause AFCS to be violated. The tradeoffs are to increase PC or decrease LS, either of which cause LDs and AFCS to decrease.

As a summary of the current plan, the following tradeoffs have been implicitly made. First, cumulative opportunity is fixed so that the minimum required opportunity is exceeded. Then, PC is fixed as calculated by the sum of the changes to end strength, required losses, and promotion out of grade. In this case, PC equals vacancies expected using the projected OFIP numbers. Finally, the current plan allows LD and AFCS to vary based on the other calculations. The different methods of altering these variables will be discussed in the next section.

D. METHODS OF ALTERING THE PROMOTION VARIABLES

1. Promotion Capability

PC can be affected in three ways. These options are graphically portrayed in Figure 5.2 for the rank of COL.

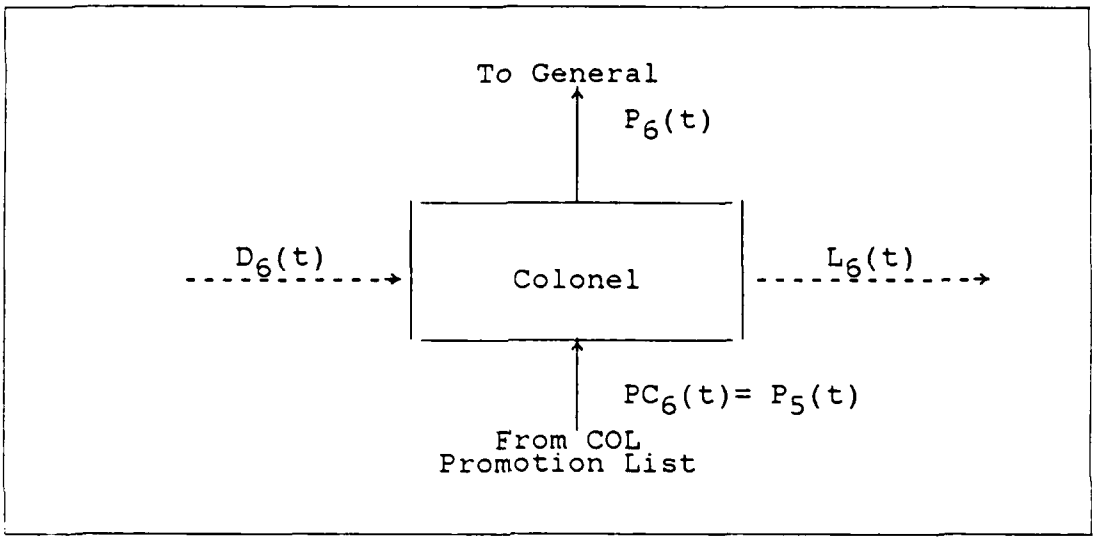


Figure 5.2 COL Promotion Capability

In Figure 5.2, the three primary ways of altering $PC_6(t)$ are to:

a) Change the COL required losses, $L_6(t)$.

b) Change the end strength authorizations for COL which would be a change in the DOPMA delta $D_6(t)$ for this rank.

c) Change the number of promotions to the next higher rank, $P_6(t)$.

PC could then be altered in the promotion plan, and the result on the other variables could be measured. If the result is preferred, a set of alternatives to change the PC would then exist.

2. Promotion Opportunities

MILPERCEN force planners have come up with a set of promotion opportunities which insure that the minimum promotion opportunity is exceeded. Alternatives methods for all i would be to:

a) Provide the total opportunity from the IZ, IO_i.

b) Decrease the BZ opportunity BO_i and increase the other chances.

c) Increase the AZ opportunity AO_i and decrease the other chances.

Each of these decisions may have consequences which are less desirable than meeting the promotion timing. These type of exercises cannot be conducted without a model like Proplan which allows the user to repetitively and accurately run the promotion plan under different input assumptions.

3. Promotion Timing

LD and AFCS are related as AFCS accumulates the differences between actual LDs and the duration goal of 12 months. Promotion timing can effectively only be changed by altering the LD. A goal of the force planner may be to maintain AFCS at the level of the current year by the time the out years are completed. This would require that the average LD be 12 months.

E. ALTERING COL PC WITH PROPLAN

1. Problem Description

A recent study conducted by MILPERCEN will now be demonstrated using the Proplan and the exec programs. The problem was to determine the effect of a proposed retirement plan on the promotion forecast. The actual mechanics of incorporating a simple change to the input data, running Proplan again, and then graphing the output will be shown in this problem. Further manual computations will demonstrate

the types of tradeoff analyses which are typically conducted at MILPERCEN.

A proposed retirement plan that would offer retirement incentives to senior officers was presented for approval to MILPERCEN. The retirement plan was seen to effectively change the number of expected losses which would be achieved at the COL rank. Specifically, the retirement plan would offer incentives for COLs to retire at the 24, 26, and 28 time in service (TIS) year marks. At the same time, extra compensation would be offered to those COLs who did not retire. MILPERCEN calculated the net effect of this plan by assuming that the average COL retired at 27.4 years TIS. In this analysis, gains after expected retirement exceeded losses before retirement by 34 COLs. The accuracy of these numbers is not important, as the primary goal is to demonstrate Proplan.

2. Calculating the Input Data for Proplan

The retention of 34 COLs each year effectively reduces $PC_6(t)$, if the retirement plan is accepted. For data input into Proplan, this change can be implemented by reducing any of the variables $L_6(t)$, $D_6(t)$, or $P_6(t)$ by 34 for t=2,.,T. As $L_6(t)$ is the largest and the easiest to change, L will be used as the altered input variable. The adjusted $PC_6(t)$ values are shown in Table 16, while the adjusted $L_6(t)$ values are shown in Table 17. This data can then be input into Proplan and the effects of this change can be measured on the promotion forecast at all the ranks.

3. Changing Input Data with Proplan

The mechanics of using the Pro exec in conjuction with Proplan will now be demonstrated. The requirement is to change $L_6(t)$ to the values of Table 17, then execute Proplan again. This is broken up into the three sections and figures which follow, but all consist of one execution

TABLE 16

CHANGE IN COL PC FOR THE RETIREMENT PLAN

	PY85	86	87	88	89	90	Total
Original	443	540	537	534	541	526	3121
Change	409	506	503	500	507	492	2917
t	(2)	(3)	(4)	(5)	(6)	(7)	

TABLE 17

CHANGE IN COL LOSSES FOR THE RETIREMENT PLAN

	PY85	86	87	88	89	90
Original	559	425	487	484	491	476
Change	525	391	453	450	457	442
t	(2)	(3)	(4)	(5)	(6)	(7)

of the Pro exec. Figure 5.3 assumes that the user has just completed execution of the original plan. This start point has been chosen so that the use of 'change' files can be demonstrated.

The basis of setting up temporary 'change' copies of the original files is to allow the user to save the original input files. This may be important if the user incorporates many changes to the input files and wants to identify the changes by (fn). This also reduces input data entry errors for multiple executions of Proplan.

In Figure 5.3, copies of the original files are initially stored under the (fn) of 'RUN3'. Change copies

```
*** EXECUTE THE MODEL WITH THE ORIGINAL INPUT ***

DO YOU WANT TO RUN THE MODEL AGAIN?
ENTER 0-NO, 1-YES
1

DO YOU WANT TO MAKE TEMPORARY
COPIES OF THE ORIGINAL DATA FILES?
ENTER 0-NO, 1-YES
1

SPECIFY THE TEMP (FN) FOR THE
FIRST INPUT DATA FILE:
run3

YOUR ORIGINAL INPUT DATA FILE
NOW RESIDES UNDER THE (FN) OF RUN3
YOUR CHANGE COPY NOW RESIDES
UNDER THE (FN) OF FILE

DO YOU WANT TO CHANGE ANY DATA
IN THE FIRST INPUT DATA FILE?
ENTER 0-NO, 1-YES
1

YOU MAY NOW CHANGE DATA IN
THE FIRST INPUT DATA FILE:

*** XEDIT FILE 10 , 'SAVE', AND 'ENTER' ***

SPECIFY THE TEMP (FN) FOR THE
SECOND INPUT DATA FILE:
run3

YOUR ORIGINAL INPUT DATA FILE
NOW RESIDES UNDER THE (FN) OF RUN3
YOUR CHANGE COPY NOW RESIDES
UNDER THE (FN) OF FILE

DO YOU WANT TO CHANGE ANY DATA
IN THE SECOND INPUT DATA FILE?
ENTER 0-NO, 1-YES
0

SPECIFY THE TEMP (FN) FOR THE
THIRD INPUT DATA FILE:
run3

YOUR ORIGINAL INPUT DATA FILE
NOW RESIDES UNDER THE (FN) OF RUN3
YOUR CHANGE COPY NOW RESIDES
UNDER THE (FN) OF FILE

DO YOU WANT TO CHANGE ANY DATA
IN THE THIRD INPUT DATA FILE?
ENTER 0-NO, 1-YES
0

PROVIDE (FN) (FT) (FM) OF PROGRAM TO BE EXECUTED
proplan watfiv
```

Figure 5.3 Retirement Plan, Changing the CLs

reside under the (fn) of 'FILE', and these will be the copies on which the user changes $L_6(t)$. The requirement is to change the first five elements in column 1 of File 10 to the corresponding values of Table 17. After these changes are made, the file is saved, and control is returned to the Pro exec. The remainder of Figure 5.3 then sets the (fn) for the change copies of the remaining files, and execution of Proplan begins again.

4. Executing Proplan with the New Input

Execution of Proplan is started again by entering 'PROPLAN WATFIV'. The continuation of this problem is shown in Figure 5.4. New ouput data (fn)s are specified so that the following files are generated by executing Proplan:

a) C3 Data A1
b) L3 Data A1
c) M3 Data A1

The new output data files contain the promotion forecasts for the COL, LTC, and MAJ ranks. These plans can also be viewed on the screen, printed out along with the input files, or transferred to APL for graphical output.

5. Replacing the Original Files

After Proplan is executed again, and the choices are made on the remaining questions of the Pro exec, the user has the option of executing the model again. A 'No' response offers the user the capability to replace the temporary copies of the original input files as the permanent copies. This is demonstrated in Figure 5.5. 'Permanent' or 'working' copies refer to those files whose (fn) is 'FILE'. These are the actual input files which will be read during the execution of Proplan.

```
PROVIDE (FN) (FT) (FM) OF PROGRAM TO BE EXECUTED
proplan watfiv

SPECIFY THE (FN) FOR THE
FIRST INPUT DATA FILE:
file

SPECIFY THE (FN) FOR THE
SECOND INPUT DATA FILE:
file

SPECIFY THE (FN) FOR THE
THIRD INPUT DATA FILE:
file

SPECIFY THE TARGET DATA FILES FOR OUTPUT
THE (FT) AND (FM) ARE SET AS 'DATA A1'
USE ANY AUTHORIZED (FN) FOR EACH PLAN

SPECIFY THE (FN) FOR THE COL PROMOTION
PLAN, USE A (FN) SUCH AS 'CX...'
c3

SPECIFY THE (FN) FOR THE LTC PROMOTION
PLAN, USE A (FN) SUCH AS 'LX...'
l3

SPECIFY THE (FN) FOR THE MAJ PROMOTION
PLAN, USE A (FN) SUCH AS 'MX...'
m3

WOULD YOU LIKE TO COMPILE A NEW PROGRAM?
ENTER 0-NO, 1-YES
1

You will be linked to the WATFIV
virtual machine at virtual address
120 and at mode B for the execution
of your WATFIV program.

ENTER THE CURRENT BOARD YEAR:
84

STATEMENTS EXECUTED=     768
```

Figure 5.4 Retirement Option, Executing Proplan

6. Analyzing the Output

The output from running the Proplan using the retirement option input data can be analyzed in two ways. The first method is to calculate the total LD change on all the lists and then compare this to the change in total PC. These may be done manually and very easily using AFCS at

```
DO YOU WANT TO RUN THE MODEL AGAIN?
ENTER 0-NO, 1-YES

0

DO YOU WANT TO REPLACE THE ORIGINAL
INPUT FILES AS THE PERMANENT COPIES?
Enter 0-NO, 1-YES

1

DO YOU WANT TO REPLACE THE FIRST
CHANGE FILE WITH THE ORIGINAL FILE AS
THE PERMANENT INPUT COPY?
ENTER 0-NO, 1-YES

1

YOUR ORIGINAL INPUT FILE IS NOW
(FN) FILE, YOUR CHANGE COPY IS
NOW (FN) RUN3

DO YOU WANT TO ERASE YOUR CHANGE
COPY OF THE INPUT DATA FILE?
ENTER 0-NO, 1-YES

1

DO YOU WANT TO REPLACE THE SECOND
CHANGE FILE WITH THE ORIGINAL FILE AS
AS THE PERMANENT COPY?
ENTER 0-NO, 1-YES

1

YOUR ORIGINAL INPUT FILE IS NOW
(FN) FILE, YOUR CHANGE COPY IS
NOW (FN) RUN3

DO YOU WANT TO ERASE YOUR CHANGE
COPY OF THE INPUT DATA FILE?
ENTER 0-NO, 1-YES

1

DO YOU WANT TO REPLACE THE THIRD
CHANGE FILE WITH THE ORIGINAL FILE AS
THE PERMANENT COPY?
ENTER 0-NO, 1-YES

1

YOUR ORIGINAL INPUT FILE IS NOW
(FN) FILE, YOUR CHANGE COPY IS
NOW (FN) RUN3

DO YOU WANT TO ERASE YOUR CHANGE
COPY OF THE INPUT DATA FILE?
ENTER 0-NO, 1-YES
1
```

Figure 5.5 Retirement Option, Replacing the Temporary Files

each rank. The second method is to graph the LD, or AFCS, to get a better idea on when the effects occur.

a. Comparing PC and LD Manually

The procedure for measuring the effect of changing $PC_6(t)$ on $LD_i(t)$ for i=4,5,6 and t=2,...,T requires the user to calculate only a few numbers. The total decrease in $PC_6(t)$ is 204, as shown in Table 16. The effect on total LD for each rank is calculated as the difference in final AFCS, before and after the input change. Table 18 shows these effects with AFCS shown in years and months.

TABLE 18

COMPARISON OF AFCS WITH THE $PC_6(t)$ CHANGE

	COL AFCS	LTC AFCS	MAJ AFCS
Before	23 3	16 7	11 4
After	23 8	16 9	11 4
Increase	5	2	0

The recommendation at MILPERCEN was that the effect on LD and AFCS for COLs was unacceptable, even though the effects on the other ranks were not severe. Changes in $PC_6(t)$ and $LD_6(t)$, denoted by $\Delta PC_6(t)$ and $\Delta LD_6(t)$, can now be computed for t=2,...,T. This problem shows that $\Delta PC_6(t)/\Delta LD_6(t)=204/5=40.8$, which means that a one month increase in COL LD will be caused by decreasing PC by about 41 COLs. A similiar type of calculation could also be performed with the other LDs.

b. Comparing PC and LD Graphically

In order to graph the output from the execution of Proplan, the user must transfer the output data files to APL WS PRPLAPL. These data files have the alphanumeric headings removed, and are transferred using the TRANS exec. To do this, a second set of data files is set up as:

1. C3A Data A1
2. L3A Data A1
3. M3A Data A1

Figure 5.6 shows the effects of changing $PC_6(t)$ on the LD for each of the ranks. Two effects shown are that the increase in LD dampens out by the MAJ rank is reached, and the increase is shifted to later years as it moves through the rank structure. Neither of these observations is easily made without some type of graphics capability.

F. AMEDD / OPMD EXAMPLE USING PROPLAN

1. Problem Description

A second study conducted by MILPERCEN will now be demonstrated using Proplan and the exec programs. This problem requires many of the same techniques used in the last problem so less detail will be included on the operation of the programs.

An analysis was conducted in November of 1984 by MILPERCEN and the DCSPER to evaluate the feasibility of promoting to total Army vacancies. This is in contrast to the current method of promoting to vacancies within each competitive category. The idea was to achieve equity in AFCS (promotion timing) between the OPMD and the AMEDD (Army Medical and Dental Corps) officers. The concern was that AMEDD was promoting FG officers much later than OPMD managed officers. The method proposed would be to calculate PC based on respective list sizes, giving each category the

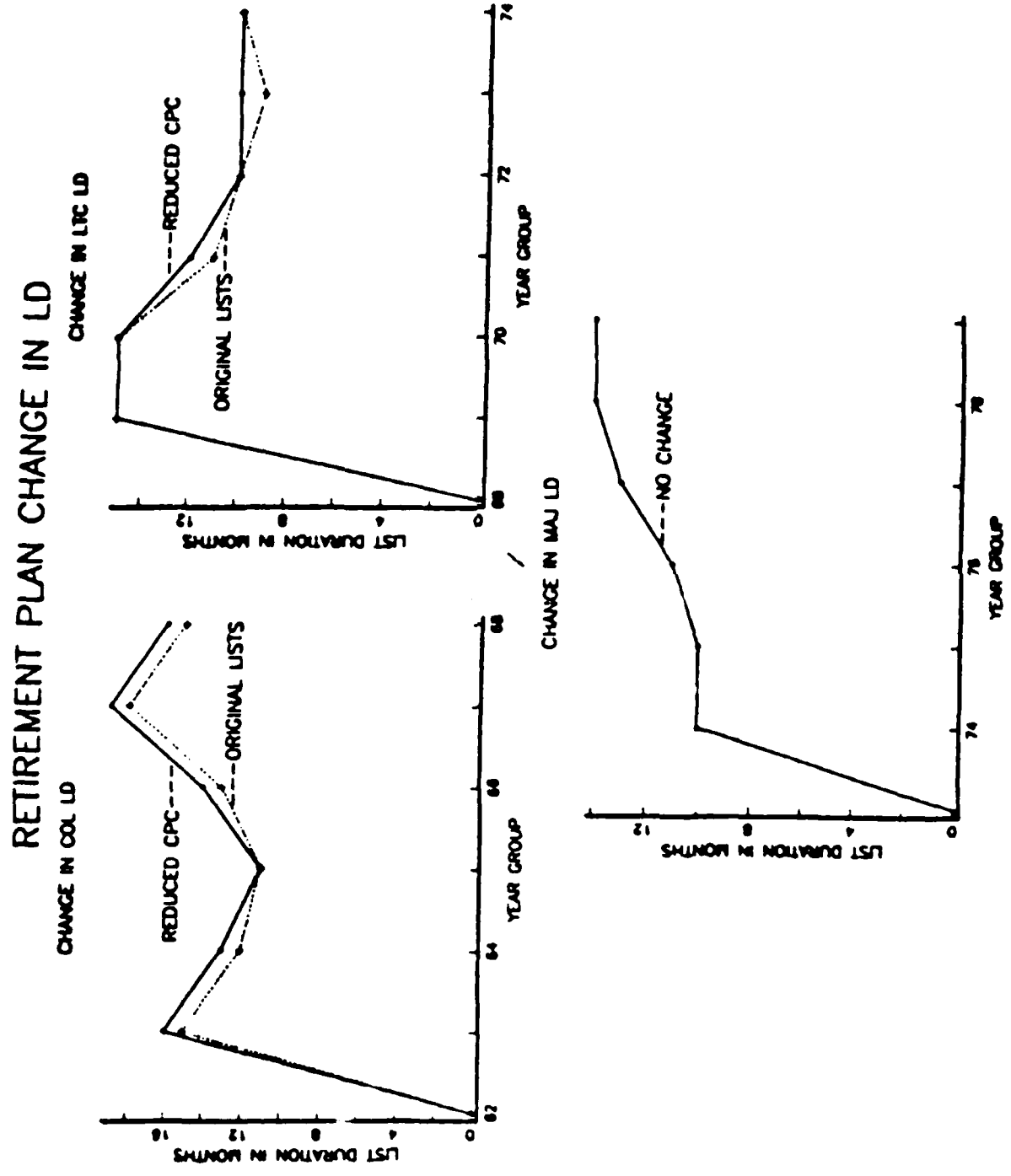


Figure 5.6 Retirement Plan Change in LD

same percentage (PC/LS x 100%). This would require the shifting of PC from OPMD to AMEDD, which was taken to mean that the authorized end strength for OPMD would be reduced. The question is 'what effect would this have on the forecasted promotion plans for OPMD?'.

2. Calculating the Input Data for Proplan

The first requirement for MILPERCEN was to calculate what effect this proposal would have on their PC for each rank. The results are shown in Table 19, where PC is indexed again by the promotion year. Notice that no changes for the first PY were anticipated. This will again require a calculation on the reduction of losses L for each rank. The adjusted values for $L_i(t)$ for i=4,5,6 and t=2,...,T are shown in Table 20. This data will be input into the Proplan and the effects of altering PC in all the ranks can be measured on the promotion forecast.

TABLE 19

CHANGE IN PC FOR THE AMEDD/OPMD PLAN

	PY85	86	87	88	89	90	Total
$PC_6(t)$							
Original	443	540	537	534	541	526	3121
Change	443	546	530	541	552	528	3140
$PC_5(t)$							
Original	1456	1499	1686	1679	1706	1739	9765
Change	1456	1439	1569	1530	1596	1625	9215
$PC_4(t)$							
Original	2257	2273	2342	2315	2309	2312	13808
Change	2257	2125	2253	2232	2313	2321	13501
t	(2)	(3)	(4)	(5)	(6)	(7)	

TABLE 20

CHANGE IN L FOR THE AMEDD/OPMD PLAN

	PY85	86	87	88	89	90
$L_6(t)$						
Original	559	425	487	484	491	476
Change	559	431	480	491	502	478
$L_5(t)$						
Original	890	918	1149	1145	1165	1213
Change	890	858	1032	996	1055	1099
$L_4(t)$						
Original	641	628	656	636	603	573
Change	641	480	567	553	607	582
t	(2)	(3)	(4)	(5)	(6)	(7)

3. Changing the Input Data with Proplan

Some additional capabilities within the Pro exec will be demonstrated in this problem. The first requirement is to change the losses for each rank as shown in Table 20. This is accomplished by using similiar commands to those used in the last problem, as outlined below:

a) Run the Pro exec with the original output files.
b) Specify output files with filenames C1, L1, and M1.
c) Answer 'Yes' to running the model again.
d) Set up 'change' copies of the input data files.
e) Specify a set of temporary (fn)s for the original input files.
f) Edit the first input file to incorporate the changes of Table 20 (all changes are in column 1).

After performing these steps, the model is ready to execute again. The following discussion assumes that the user has edited File 10, and the 'change' copies are in the permanent status.

4. Executing Proplan with the New Input

Now that the input files have the changes to L for each rank, execution of Proplan begins again. The continuation of this problem is shown in Figure 5.7. In order to more efficiently use the Trans exec, a second Watfiv program has been created under the (fn) of 'PROPLGR'. This program is identical to Proplan, but with the 'WRITE' commmands for the heading generating statements of the output files removed. This enables the user to quickly create and transfer data to APL, without leaving the Pro exec.

Figure 5.7 shows that a second execution of the Pro exec is made, specifying new data output (fn)s. This set of responses creates output files which are ready for transfer to APL.

5. Transferring Files to APL within Pro

The transfer of these new output data files to APL WS PRPLAPL is demonstrated in Figure 5.8. These responses are a continuation of the last set in Figure 5.7, and show that the transfer can be made repetitively at this stage. This feature is particularly useful when many data files need to be transferred to APL.

6. Analyzing the Output

The output from running the AMEDD/OPMD input data will be analyzed both graphically and manually. The manual analysis is presented in a table format so that the changes are more apparent. Ratios, or rates, such as those developed in the last problem could be developed also. This would require the calculation of ΔPC and ΔLD, and then development of a ratio such as ΔPC / ΔLD. This type of ratio would only be meaningful at the COL rank. At the other ranks, the additional effect of a change in the PC at the higher ranks would be present. Because of these considerations, ratios will not be used in this problem.

```
PROVIDE (FN) (FT) (FM) OF PROGRAM TO BE EXECUTED
proplgr watfiv
SPECIFY THE (FN) FOR THE
FIRST INPUT DATA FILE:
file
SPECIFY THE (FN) FOR THE
SECOND INPUT DATA FILE:
file
SPECIFY THE (FN) FOR THE
THIRD INPUT DATA FILE:
file
SPECIFY THE TARGET DATA FILES FOR OUTPUT
THE (FT) AND (FM) ARE SET AS 'DATA A1'
USE ANY AUTHORIZED (FN) FOR EACH PLAN
SPECIFY THE (FN) FOR THE COL PROMOTION
PLAN, USE A (FN) SUCH AS 'CX...'
c4a
SPECIFY THE (FN) FOR THE LTC PROMOTION
PLAN, USE A (FN) SUCH AS 'LX...'
14a
SPECIFY THE (FN) FOR THE MAJ PROMOTION
PLAN, USE A (FN) SUCH AS 'MX...'
m4a
WOULD YOU LIKE TO COMPILE A NEW PROGRAM?
ENTER 0-NO, 1-YES
1
*** MODEL EXECUTES AGAIN, ANSWER '0' ***
***    TO THE REMAINING QUESTIONS      ***
DO YOU WANT TO EXECUTE THE TRANS EXEC?
ENTER 0-NO, 1-YES
1
```

Figure 5.7 Use of the PROPLGR Program

a. Comparing PC and AFCS Manually

The procedure for showing the effect of changing PC on LD, and on AFCS, requires the user to refer to the

```
DO YOU WANT TO EXECUTE THE TRANS EXEC?
ENTER 0-NO, 1-YES
1

BE SURE THAT ANY FILES TRANSFERRED TO APL
HAVE THE ALPHANUMERIC HEADINGS REMOVED

ENTER THE (FN) AND (FT) OF THE
FILE TO BE TRANSFERRED TO APL:
(FILE MUST BE A NUMERIC FILE)

c4a data

ENTER THE NAME OF THE APL VARIABLE
THAT WILL STORE THIS DATA:

c4a

ENTER THE NAME OF THE APL WS THAT
YOU WANT THE VARIABLE C4A TO BE
STORED IN:

prplapl

*** TRANS EXECUTES ***

*** TRANSFER REMAINING OUTPUT DATA FILES ***

DO YOU WANT TO EXECUTE THE TRANS EXEC AGAIN?
ENTER 0-NO, 1-YES
0

DO YOU WANT TO RUN THE MODEL AGAIN?
ENTER 0-NO, 1-YES
0
```

Figure 5.8 Using Pro to Transfer Files to APL

output data files just created. A comparison of LDs can then be made at each rank with the original lists. This data is consolidated in Table 21. Table 21 shows that there has been an decrease of 1 month, and an increase of 4 months and 5 months in LD at the COL, LTC, and MAJ ranks respectively. The net changes are presented in summary table format as Table 22.

It is concluded from this analysis that the LTC and MAJ LDs will be delayed even further. The recommmendations resulted in a decision not to accept the AMEDD/OPMD

TABLE 21

EFFECT OF PC CHANGE ON LD

	PY85	86	87	88	89	90	Total
$LD_6(t)$							
Original	15	12	11	13	18	15	84
Change	15	12	11	13	17	15	83
$LD_5(t)$							
Original	15	15	11	10	9	10	70
Change	16	16	12	10	10	10	74
$LD_4(t)$							
Original	10	10	11	13	14	14	72
Change	10	11	12	14	15	15	77
t	(2)	(3)	(4)	(5)	(6)	(7)	

TABLE 22

SUMMARY OUTPUT OF THE AMEDD/OPMD PLAN

Totals	COL	LTC	MAJ
Change PC	3140	9215	13501
Original PC	3121	9765	13808
Difference	19	-550	-307
Change LD	83	74	77
Original LD	84	70	72
Difference	-1	4	5
Change AFCS	23 2	16 11	11 9
Original AFCS	23 3	16 7	11 4
Difference	-1	4	5

plan because of the impact on the OPMD MAJ and LTC rank. The effect by YG can be seen graphically in the next section.

b. Comparing PC and LD Graphically

Using the PROPLGR program allows the user to immediately graph the output. Figure 5.9 shows the effects of changing PC on the LD for each rank. These graphs show visually how LD is changed and which YGs are effected. Similiar graphs for AFCS could also be implemented showing the cumulative change in LD.

G. ALTERING PC TO MEET LD GOALS

The emphasis of this section is to show how to fully utilize the capabilities of Proplan and the exec programs. This will be performed within the context of a very specific problem.

1. Problem Description

A hypothetical problem that was introduced earlier in this chapter will now be solved. The problem is to come up with a set of PCs at each rank which will make all the LDs less than or equal to 12 months. This solution would effectively maintain or reduce the AFCS from the initial value to its final value. The assumption is that not meeting the AFCS guidelines is a real concern for force planners at MILPERCEN, and that the tradeoff to consider is in terms of PC.

2. Solution Methodology

The approach taken in this problem is to look at the original promotion plan and increase PC where needed to decrease LD to values no greater than 12 months. The actual increase of PC will be implemented by an increase of L,

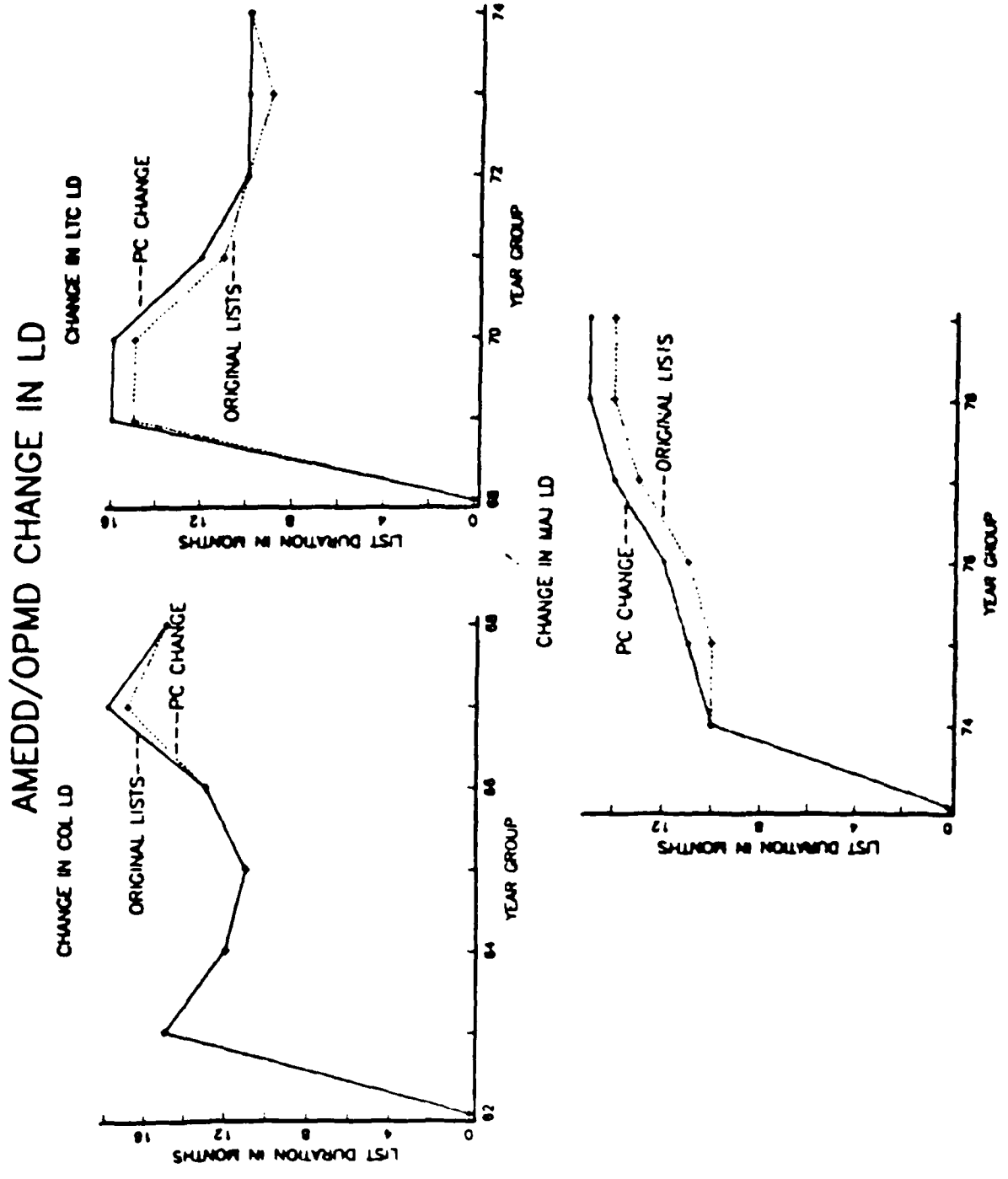


Figure 5.9 AMEDD/OPMD Change in LD

starting with the COL rank. The only way to reduce $LD_6(t)$ is to increase $L_6(t)$ one year at a time until the goal is met. By working through the COL rank, changes will also occur in the other ranks. These changes will automatically be incorporated into the results as the change copies of the input files will be updated at each iteration.

The solution to this problem will be unique if the following rules are applied:

a) Start with the first $LD_6(t)$ which is > 12 months.
b) Increase $L_6(t)$ for this year until that year's LD is ≤ 12 months.
c) Continue through the COL rank until $LD_6(t) \leq 12$ months for all t.
d) Do not change PC for any year in which the LD is ≤ 12 months already.
e) Save these changes and use the same method on the next rank.
f) Stop when $LD_i(t) \leq 12$ months for all i and t.

The only source for differences in the solution will be in the magnitude of the loss increases.

The solution to this problem will actually produce a set of losses which are greater than the original ones. This will then be converted back into the corresponding PC so that this can be compared with the original PC. The actual change each year in PC is also important to a decision maker since a decision can then be made each year to increase PC through losses, promotions out of grade, or end strength increases. Sensitivity ratios could also be calculated to measure the rate of change in LD to change in PC.

3. Solving for the COL Losses

This entire problem can be solved efficiently without ever leaving the Pro exec. The additional capabilities of viewing the output data files at the terminal and

repetitively changing input data files are useful in this problem. As a reference, Table 23 summarizes the initial characteristics of interest in the original plan.

TABLE 23
ORIGINAL COL PROMOTION LIST DATA

	COL						
	PY85	86	87	88	89	90	Total
$PC_6(t)$	443	540	537	534	541	526	3121
$L_6(t)$	559	425	487	484	491	476	2922
$LD_6(t)$	15	12	11	13	18	15	84
t	(2)	(3)	(4)	(5)	(6)	(7)	

By looking at $LD_6(t)$ in Table 23, $L_6(2)$ must be increased until $LD_6(2)$ is no greater than 12 months. The mechanics of using the Pro, Proplan, and solution rules are outlined below:

a) Run the model with the original data.
b) Set up 'change' copies of the input data files.
c) Edit these new files so that $L_6(2)$ is increased.
d) Execute the model again, specifying a new (fn) for the output data file.
e) View the output file and check $LD_6(2)$.
f) If $LD_6(2)$ is $\leq$ 12, then increase $L_6(5)$ in the same manner, editing the same change file.
g) If $LD_6(2)$ is > 12, try again with a larger increment.
h) Iterate through these procedures, moving to a new rank as needed.
i) Stop when $LD_i(t)$ is $\leq$ 12 for all i and t.

4. Solution Set for COL PC

The solution rules are implemented for incrementing $L_6(t)$ to generate a set of $PC_6(t)$ values such that $LD_6(t)$ is no greater than 12 months for all t. A starting value for $PC_6(t)$ is chosen close to $LS_6(2)$=588, which corresponds to a value for $L_6(2)$ of 704. $L_6(2)$ is initially set at 600, with increments of 25. In order for $LD_6(2)$ to be reduced to 12 months, $L_6(2)$ must be incremented to 700. These procedures are successively iterated to give a set of losses $L_6(t)$ for t=2,...,T. These values are converted to PC values as shown in Table 24. $\Delta PC_6(t)$ in this table is the solution set for $PC_6(t)$ minus the original $PC_6(t)$ values in Table 23 for t=2,...,T.

TABLE 24
SOLUTION SET FOR THE COL PROMOTION LISTS

	COL						
	PY85	86	87	88	89	90	Total
$PC_6(t)$	584	540	537	575	800	625	
$\Delta PC_6(t)$	141	0	0	41	259	99	540
$L_6(t)$	700	425	487	525	750	575	
$LD_6(t)$	12	12	10	12	12	12	70
t	(2)	(3)	(4)	(5)	(6)	(7)	

From this analysis, it appears that the largest increases in $PC_6(t)$ must be obtained for t=2 and t=6. The original reason for the long LDs can then be examined. $LD_6(2)$ is 15 months because of a low value for $PC_6(2)$. This results from a large decrease in end strength in t=2. The

value for $LD_6(6)$ is high because of a large promotion list. This results from a large LTC YG that is projected to enter the promotion window in BY88 (t=5). The tradeoff at this stage is that 14 months of COL LD can be gained for a 540 increase in COL PC. The added benefit is that COL AFCS would be at 22 years and 4 months by the end of the forecast, if this set of $PC_6(t)$ values were attained.

5. Solution Set for LTC PC

The original set of $PC_5(t)$ values have been changed by the increase in $PC_6(t)$. This occurs as $PC_6(t) = P_5(t)$ for all t. These changes have also altered the values for $LD_5(t)$. Before changes can be made to $L_5(t)$, these effects must be tabulated. Table 25 shows the results on the LTC rank caused by the change in $PC_5(t)$. Notice that the changes in $PC_6(t)$ from the COL solution set are transferred directly to the LTC rank. This has resulted in a two month decrease in LTC AFCS already.

The requirements to increment $L_5(t)$ are now implemented as before. To do this, $L_5(2)$ must be increased so that $PC_5(2)$ is close to the $LS_5(2)$ value. This means that $L_5(2)$ must be incremented by about 300 as a start point. An increment is then chosen and $L_5(2)$ is increased until $LD_5(2)$ is no greater than 12 months. This procedure is continued until both $LD_5(2)$ and $LD_5(3)$ are no greater than 12 months.

The solution set for the $PC_5(t)$ values are shown in Table 26 for t=2,...,T. $\Delta PC_5(t)$ is the solution set values for $PC_5(t)$ minus the set of $PC_5(t)$ values resulting from the COL PC solution set. This means that $\Delta PC_5(t)$ is only the additional PC which must be obtained after implementing the COL solution set.

A practical problem arises in implementing the solution rules at this rank. The problem is that the LTC list brought forward to PY85 is very large. This causes

TABLE 25

INTERIM LTC PROMOTION LIST DATA

	LTC						
	PY85	86	87	88	89	90	Total
Change $PC_5(t)$	1597	1499	1686	1720	1965	1838	10305
Original $PC_5(t)$	1456	1499	1686	1679	1706	1739	9765
Difference	141	0	0	41	259	99	540
Change $LD_5(t)$	15	15	11	9	9	9	68
Original $LD_5(t)$	15	15	11	10	9	10	70
Difference	0	0	0	-1	0	-1	-2
$L_5(t)$	890	918	1149	1145	1165	1213	6480
t	(2)	(3)	(4)	(5)	(6)	(7)	

TABLE 26

SOLUTION SET FOR THE LTC PROMOTION LISTS

	LTC						
	PY85	86	87	88	89	90	Total
$PC_5(t)$	1957	1931	2137	1720	1965	1838	11548
$\Delta PC_5(t)$	360	432	451	0	0	0	1243
$L_5(t)$	1250	1350	1600	1145	1165	1213	7723
$LD_5(t)$	12	12	10	9	8	9	60
t	(2)	(3)	(4)	(5)	(6)	(7)	

promotion lists to extend into later years. For example, the PY86 LTC list extends well into PY88 originally. Some judgement must then be used in the solution technique when lists back up in this manner. This solution assumes that $PC_5(4)$ will be increased in order to meet the goal of 12 months on all the lists.

The LTC promotion lists are in need of additional PC very early in the promotion forecast. This results from extremely large YGs which enter the promotion window from YG69 and YG70. The tradeoff using this solution is that 8 months of LTC LD can be gained for a 1243 increase in LTC PC. The overall effect from both the COL and LTC changes in PC would then be a 10 month decrease in LTC AFCS. The final AFCS would then be less than 16 years if both the COL and LTC solution set PCs were attained.

6. Solution Set for the MAJ PC

The original set of $PC_4(t)$ values have also been changed by the $PC_5(t)$ and $PC_6(t)$ changes. Table 27 shows the results on the MAJ rank caused by both of these changes. Notice again that the difference in $PC_4(t)$ in Table 27 is the sum of the differences in $PC_5(t)$ from Tables 25 and 26. This has resulted in an 8 month decrease in MAJ AFCS already.

The requirement is to increment $L_4(5)$ until $LD_4(5)$ is no greater than 12 months. An initial guess on the increment is 120, as this is the difference in LS and PC for t=5 at this rank. $L_4(5)$ is then initially changed to 650 and increments of 20 are chosen. A solution for $L_4(5)$ is reached with one increment, so that the increment is reset at 10. This procedure results in a solution for $L_4(5)$ of 660. Similiar logic must then be followed until $LD_4(6)$ and $LD_4(7)$ are no greater than 12 months.

The solution set for $PC_4(t)$ is given in Table 28 for t=2,...,T. $\Delta PC_4(t)$ is again only that additional PC which must be gained after implementing the $PC_5(t)$ and $PC_6(t)$ solution sets.

TABLE 27
INTERIM MAJ PROMOTION LIST DATA

	MAJ						
	PY85	86	87	88	89	90	Total
Change $PC_4(t)$	2758	2705	2793	2356	2568	2411	
Original $PC_4(t)$	2257	2273	2342	2315	2309	2312	
Difference	501	432	451	41	259	99	1783
Change $LD_4(t)$	8	8	9	13	13	13	64
Original $LD_4(t)$	10	10	11	13	14	14	72
Difference	-2	-2	-2	0	-1	-1	-8
$L_4(t)$	641	628	656	636	603	573	
t	(2)	(3)	(4)	(5)	(6)	(7)	

The MAJ promotion lists are seen to be in need of additional PC only in the out years. This is due to large YGs entering the promotion window to MAJ in the last three years. The tradeoff using this solution is that 3 additional months of LD can be gained for a 323 increase in MAJ PC. The cumulative effect of changing the COL, LTC, and MAJ PC would be an 11 month decrease in AFCS. The final MAJ AFCS would then be 10 years and 5 months, if all of these solution sets in PC were obtained.

TABLE 28

SOLUTION SET FOR THE MAJ PROMOTION LISTS

	MAJ						
	PY85	86	87	88	89	90	Total
$PC_4(t)$	2758	2705	2793	2380	2665	2613	
$\Delta PC_4(t)$	0	0	0	24	97	202	323
$L_4(t)$	641	628	656	660	700	775	
$LD_4(t)$	8	8	9	12	12	12	61
t	(2)	(3)	(4)	(5)	(6)	(7)	

H. SUMMARY OF THE PC AND LD EXERCISE

A means to summarize the preceeding analysis is now presented. The information needed by a decision maker is the total change in PC and effect on LD at each rank. A secondary consideration may also be to consider the resultant effect on AFCS at each rank. This type of information is presented in Table 29. This table is organized into three sections, where the effects shown are the cumulative effects of implementing the PC solution sets.

This type of exercise clearly gives a decision maker a range of tradeoffs to consider. As only the extremes are presented in Table 29, intermediate solutions could be gained by interpolation. The analyst could further use the intermediate graphs of the values of the variables before the solution set is reached for interpolation.

I. SUMMARY OF THE PROPLAN EXERCISES

The details of completing a set of typical MILPERCEN sensitivity tests has been demonstrated in this chapter.

TABLE 29

SUMMARY OF THE PC AND LD EXERCISE

Implementing the $PC_6(t)$ Solution Set

	COL	LTC	MAJ
Actual PC Change	540	0	0
Subsequent PC Change	0	540	540
Total LD Change	14	2	3
Final AFCS	22 1	16 5	11 1

Implementing the $PC_5(t)$ Solution Set

	LTC	MAJ
Actual PC Change	1243	0
Subsequent PC Change	0	1243
Total PC Change	1783	1783
LD Change	8	5
Total LD Change	10	8
Final AFCS	15 9	10 8

Implementing the $PC_4(t)$ Solution Set

	MAJ
Actual PC Change	323
Total PC Change	2106
LD Change	3
Total LD Change	11
Final AFCS	10 5

These tests have increased in complexity from a simple input change to a complex PC and LD test. All of these examples show that using the Proplan and computer exec programs in conjunction significantly increase the analytical capabilities during 'what if?' tests. The analyst is also able to present a decision maker with a clear set of tradeoffs in either a table or graphical presentation.

VI. CONCLUSIONS

This thesis has described officer promotion forecasting methods used within the U.S. Army. The procedures were formulated into a set of equations which was classified as the 'promotion model'. Though the promotion model has remained basically unchanged over the last several years, formulation of the model within a mathematical framework has added needed structure to the process.

The evolution of the promotion model has been in the implementation means. The promotion plan was produced initially by manual spreadsheet, requiring days of painstaking work. Then the model was implemented using a microcomputer spreadsheet. This later implementation has many appealing features, but has proven to be inadequate for the needs of the force planner at MILPERCEN. This thesis has shown that the proposed implementation using Proplan will meet the needs of the force planner. A set of typical MILPERCEN exercises were solved in a short period of time with accurate and clear results.

Uncertainty and changes in the officer system require an implementation of the promotion model like Proplan. The ability to analyze the effects on the promotion system by proposed changes is a primary requirement for the force planner. This thesis has demonstrated that Proplan is capable of accurately depicting promotion situations based on different input assumptions. The procedures developed also give the user a viable means to offer reliable tradeoffs to a decision maker.

The most appealing features of Proplan are its versatility and speed. These features have been demonstrated by the exec programs provided with the model. The user has a wide range of execution and graphing options with the

proposed implementation package. Some of these options were demonstrated with the exercises used in this thesis, but many more could be offered easily using exec programming. A summary of the current options include the ability:

1. To generate and save numerous promotion plans under different identifiers.
2. To view the promotion plans at each stage of the execution at the terminal, or by using printed copies.
3. To print out input and output files together, along with appropriate headings.
4. To transfer output data quickly and repetitively to a graphics package.
5. To save the original input data by using temporary change files.
6. To make changes to the input data assumptions without having to stop the model's execution.
7. To restore the original input files as the permanent input copies upon completion of the exercises.

Another important feature of Proplan is its ability for further enhancement. This could include subroutines to answer specific questions, exec programs tailored to fit individual needs, or its use as a subroutine of other models. In particular, the OFIP could be used to generate a majority of the input data. These features allow Proplan to expand based on the needs of MILPERCEN.

The accurate production of the five year promotion plan is very critical to the management of the officer corps. High level decisions are made weekly based upon the results of the promotion plan. Therefore, the analyst must have the capability to change input data, perform tradeoff analyses, and produce a product in a timely fashion. Proplan is now the tool which the analyst has available to accomplish these tasks.

APPENDIX A
DEFINITION OF TERMS

AFCS-Active Federal Commissioned Service: The active duty service as an officer in the Armed Forces, as expressed in years and months.

ADL-Active Duty List: An order of seniority list of commissioned officers on active duty in the U.S. Army, other than those listed in Title 10, USC 641.

Attrition Rate: The percentage of officers who leave the active Army in a 1-year period.

BES-Budgeted End Strength: The actual or authorized number of active Army officers at the close of the fiscal year.

Buildup: The process of increasing the size of the active Army to end and grade strengths which are substantially higher than those authorized at the existing time.

BY-Board Year: The government fiscal year in which the promotion board is actually convened to consider officers for promotion.

Career Attractiveness: The perceived advantages, compensations, and opportunities of an Army career which collectively induce officers to remain on active duty beyond their obligated service period.

Cohort: A group of officers that were commissioned in a fiscal year and are considered for promotion at the same time.

Commission: Appointment as an officer of the U.S. Army. In the specialties managed by OPMD, the officer is usually commissioned in the grade of second lieutenant. Those not managed by OPMD may be commissioned at a higher grade.

Competitive Category: A group of commissioned officers who compete among themselves for promotion.

DCSPER-Deputy Chief of Staff, Personnel: The Pentagon staff specifically tasked to conduct force planning and direct other personnel policies.

Discontinuation: The involuntarily separating from the active Army those officers who have twice failed to be selected for promotion in the above zone category, or for reasons other than non-promotion.

DOPMA-Defense Officer Personnel Management Act: The Act which establishes many of the current procedures for officer personnel management in the U.S. Army.

DOR-Date of Rank: The date on which an officer is actually promoted or appointed to a given grade as expressed in years and months.

Due-Course Officer: An officer who has never failed to be selected for promotion from the IZ category when first considered and who has never been selected from the BZ to any grade.

Force Planning: The formulation of future organizational requirements based on possible contingencies or forecasted conditions.

FY-Fiscal Year: The accounting period for the government which starts on 1 October and ends on 30 September.

Gaming: The mathematical method of picking out the best strategies in situations where choices or people are in conflict.

Grade, Officers: Each time a U.S. Army officer is promoted, the rank or grade is increased one rank from second lieutenant through the general officer ranks. These grades are grouped as company, field, and general grades.

Grade Strength: The actual or authorized number of active Army officers in a specific grade.

Grade Strength Distribution: The actual or authorized commissioned officer strength as apportioned by grade.

LD-List Duration: The elapsed time from the date the first officer on a promotion list gets promoted to the date the last officer on the promotion list gets promoted.

LR-List Remaining: The number of officers on a promotion list who must be carried forward to the following fiscal year and await promotion.

MILPERCEN: The U.S. ARMY Military Personnel Center.

OFIP-Officer Force Implementation Plan: The plan used by MILPERCEN to project the officer force five years into the future. It is the main data source for the promotion plan.

OGLA-Officer Grade Limitation Act of 1954: A public law which established an upper limit on both generals and field grade officers authorized for each fiscal year end. This limit was based on the total authorized active Army commissioned officer strength.

OPA-Officer Personnel Act of 1947: A public law which set forth the distribution of regular Army officer grade strengths as percentages of the total Regular Army authorized grade strength.

OPMS-Officer Personnel Management System: The Army policy relating to the professional development and utilization of officers, as explained in Department of the Army Pamphlet 600-3.

Phasedown: The process of decreasing the size of the active Army to end and grade strengths which are substantially lower than those previously authorized.

Promotion: The advancement of an officer from the grade held to the next higher grade.

Promotion Board: A centralized promotion process where a senior group of Army officers review the records of officers being considered for promotion and select those to be recommended to be put on a promotion list.

PC-Promotion Capability: The number of forecasted officer vacancies which will occur in the next higher grade in the following year.

Promotion Categories: The grouping of officers who are being considered for promotion based on date of rank and promotion timing as set forth in DOPMA.These three categories are:

1. ***AZ-Above Zone***: Officers on the ADL of the same grade and competitive category who are eligible for promotion consideration and whose date of rank is senior to all officers in the In Zone.
2. ***IZ-In Zone***: Officers on the ADL who are eligible for promotion at the 'normal' time as set forth in DOPMA.

3. ***BZ-Below Zone***: Same as Above Zone, but whose date of rank is junior to all officers in the In Zone.

Promotion Flow: The upward movement of officers through the grades, from second lieutenant to brigadier general.

PL-Promotion List: A list of officers, by competitive category, who have been recommended and approved for promotion.

Promotion Opportunity: The cumulative opportunity of being selected for promotion from one grade to the next, which is the sum of the opportunities for promotion from each of the three promotion categories.

Promotion Plan: The U.S. Army Five Year Field Grade Officer Promotion Plan, which forecasts the promotions of officers for five years.

Promotion Point: A given time at which an officer becomes eligible for advancement to the next higher grade as expressed by time in grade (TIG) or years of AFCS.

PR-Promotion Rate: The rate of promotions off of promotion lists during a fiscal year, which is assumed to be constant for the entire fiscal year.

Promotion Selection Rate: The percentage of officers selected for promotion out of the total number of officers considered within each promotion category. The three rates used in the models are AO, IO, and BO.

Promotion Zone: A range of dates of rank which constitutes the zone of consideration for commissioned officers on the ADL who will be considered for promotion.

RA-Regular Army: The permanent Army which is maintained in peace as well as in war, also known as the standing Army.

Selective Continuation: The permitting of officers who have failed to be promoted twice from the AZ category to remain on active duty.

YG-Year Group: A group of officers who were commissioned in a given year and remain in the active Army.

APPENDIX B

PROPLAN COMPUTER CODE

```
$JOB            ID,L=80
C     ************************************************************
C     ****                    GLOSSARY                        ****
c     ************************************************************
C     CL-COLONEL REQUIRED LOSSES AS CALCULATED BY THE OFIP
C     CP-    "    PROMOTED, 50/MONTH,LP,MP, AND CPP CALCULATED
C     CD-    "    DELETED BY DOPMA CHANGES
C     CPC-   "    PROMOTION CAPABILITY
C     CAC-   "    ABOVE ZONE CONSIDERED
C     CIC-   "    IN ZONE CONSIDERED
C     CBC-   "    BELOW ZONE CONSIDERED
C     CLR-   "    LIST REMAINING IN FOLLOWING YEAR
C     CCSY-  "    ACTIVE FEDERAL COMMISSIONED SERVICE YEARS
C     CCSM-  "    ACTIVE FEDERAL COMMISSIONED SERVICE MONTHS
C     CAFCS-"     AFCS EXPRESSED AS YRS + (MONTHS / 12.)
C     CLS-   "    LIST SIZE
C     CAIS-  "    ABOVE AND IN ZONE SELECTED
C     CPR-   "    PROMOTION RATE
C     CUL-   "    LIST USED BY PREVIOUS LIST
C     CLD-   "    LIST DURATION
C     CMR-   "    MONTHS REMAINING
C     CLE-   "    LIST EXHAUSTED IN FISCAL YEAR
```

```
C     CY-   "    YEAR GROUP
C     CAS-  "    ABOVE ZONE SELECTED FOR CURRENT BOARD YEAR
C     CIS-  "    IN ZONE SELECTED FOR CURRENT BOARD YEAR
C     CBS-  "    BELOW ZONE SELECTED FOR CURRENT BOARD YEAR
C
C     THESE SAME VARIABLES EXIST FOR LTC AND MAJ WITH L AND M ,
C     INSTEAD OF C.
C     ****                END OF GLOSSARY                    ****
C     ************************************************************
      INTEGER CL(9),CP(9),CD(9),CAC(9),CIC(9),CBC(9),CAS(9),CIS(9),CBS(9
     *),CAIS(9),CUL(9),CLD(9),CMR(15),CLE(9),CPC(9),CCSY(9),CCSM(9),LL(9
     *),LP(9),LD(9),LAC(9),LIC(9),LBC(9),LAS(9),LIS(9),LBS(9),LAIS(9),LU
     *L(9),LLD(9),LMR(15),LLE(9),LPC(9),LCSY(9),LCSM(9),ML(9),MP(9),MD(9
     *),MAC(9),MIC(9),MBC(9),MAS(9),MIS(9),MBS(9),MAIS(9),MUL(9),MLD(9),
     *MMR(15),MLE(9),MPC(9),MCSY(9),MCSM(9),CPP(9),BY,CY,LY,MY,PY
C
      REAL CAO,CIO,CBO,LAO,LIO,LBO,MAO,MIO,MBO,CPR(50),CLR(15),CLS(15),L
     *PR(50),LLR(15),LLS(15),MPR(50),MLR(15),MLS(15),CAFCS(15),LAFCS(15)
     *,MAFCS(15)
C     **** INTERACTIVELY INPUT THE CURRENT BOARD YEAR ****
      PRINT,'ENTER THE CURRENT BOARD YEAR:'
      READ,BY
C     **** ASSIGN THE IZ YG FOR ALL THREE RANKS ****
      CY=BY-21
      LY=BY-15
```

```
      MY=BY-10
      PY=BY+1
C     **** CALCULATE PROMOTION CAPABILITY FOR ALL THREE RANKS ****
      READ (10,70) (CL(I),CD(I),I=2,7)
      READ (11,75) (CP(I),I=2,7)
      DO 10 I=2,7
         CPC(I)=CL(I)+CP(I)+CD(I)
         LP(I)=CPC(I)
10    CONTINUE
      READ (10,70) (LL(I),LD(I),I=2,7)
      DO 20 I=2,7
         LPC(I)=LL(I)+LP(I)+LD(I)
         MP(I)=LPC(I)
20    CONTINUE
      READ (10,70) (ML(I),MD(I),I=2,7)
      DO 30 I=2,7
         MPC(I)=ML(I)+MP(I)+MD(I)
         CPP(I)=MPC(I)
30    CONTINUE
C     **** INPUT AND ASSIGN THE REMAINDER OF THE INPUT DATA ****
C     **** INPUT THE INVENTORY PROJECTIONS ****
      READ (10,80) (CAC(I),CIC(I),CBC(I),I=1,6)
      READ (10,80) (LAC(I),LIC(I),LBC(I),I=1,6)
      READ (10,80) (MAC(I),MIC(I),MBC(I),I=1,6)
C     **** INPUT THE ACTUAL BOARD DATA ****
```

```
      READ (11,80) CAS(1),CIS(1),CBS(1)
      READ (11,80) LAS(1),LIS(1),LBS(1)
      READ (11,80) MAS(1),MIS(1),MBS(1)
C     **** INPUT THE LIST REMAINING DATA ****
      READ (11,85) CLR(1),CCSY(1),CCSM(1)
      READ (11,85) LLR(1),LCSY(1),LCSM(1)
      READ (11,85) MLR(1),MCSY(1),MCSM(1)
C     **** INPUT THE PROMOTION OPPORTUNITIES ****
      READ (12,90) CAO,CIO,CBO
      READ (12,90) LAO,LIO,LBO
      READ (12,90) MAO,MIO,MBO
C     **** CALCULATE LIST SIZES FOR ALL THREE RANKS ****
C     **** THE FIRST LIST IS THE LIST REMAINING ****
C     **** THE SECOND LIST IS THE ACTUAL LIST FROM BOARD DATA ****
      CLS(1)=CLR(1)
      CLS(2)=CAS(1)+CIS(1)+CBS(1)
      LLS(1)=LLR(1)
      LLS(2)=LAS(1)+LIS(1)+LBS(1)
      MLS(1)=MLR(1)
      MLS(2)=MAS(1)+MIS(1)+MBS(1)
C     **** CALCULATE THE NUMBER SELECTED FOR THE COMBINED AZ AND IZ ****
C     ***** CATEGORIES FOR ALL RANKS, INDEX BY THE BOARD YEAR****
      DO 35 I=2,6
         CAIS(I)=CAC(I)*CAO+CIC(I)*CIO+.5
         LAIS(I)=LAC(I)*LAO+LIC(I)*LIO+.5
```

```
      MAIS(I) MA( I  MA  M      M
C     **** CALCULATE THE NUMBER  F M.  REQUIRED FOR ALL RANKS ****
      CBS(I)=CAIS(I) CBO  I  CB
      LBS(I)=LAIS(I) LBO  I LBO
      MBS(I)=MAIS(I) MBO  I MBO
C     **** CALCULATE THE LIST SIZES FOR ALL RANKS ****
C     **** INDEX BY THE PROMOTION YEAR ****
      CLS(I+1)=CAIS(I)+CBS(I)
      LLS(I+1)=LAIS(I)+LBS(I)
      MLS(I+1)=MAIS(I)+MBS(I)
35    CONTINUE
C     **** CALCULATE PROMOTION RATE FOR ALL THREE RANKS  ****
      DO 45 I=2,7
      CPR(I)=AINT(FLOAT(CPC(I))/12.+.5)
      LPR(I)=AINT(FLOAT(LPC(I))/12.+.5)
      MPR(I)=AINT(FLOAT(MPC(I))/12.+.5)
45    CONTINUE
C     **** ASSIGN PROMOTION RATES FOR THE EXTRA YEARS AS ****
C     **** NEEDED, SET EQUAL TO THE LAST YEAR'S FORECAST ****
      DO 50 I=7,49
      CPR(I+1)=CPR(I)
      LPR(I+1)=LPR(I)
      MPR(I+1)=MPR(I)
50    CONTINUE
C     **** CALCULATE LIST DURATION FOR ALL THREE RANKS ****
```

```
         CALL DUR(CPR,CUL,CLR,CMR,CLE,CLS,CLD,CPC)
         CALL DUR(LPR,LUL,LLR,LMR,LLE,LLS,LLD,LPC)
         CALL DUR(MPR,MUL,MLR,MMR,MLE,MLS,MLD,MPC)
C        **** CALCULATE YR AND MONTH OF AFCS    ****
      CALL AFCS(CCSY,CCSM,CLD)
      CALL AFCS(LCSY,LCSM,LLD)
      CALL AFCS(MCSY,MCSM,MLD)
C     **** CALCULATE AFCS FOR ALL THREE RANKS ****
      DO 52 I=2,7
         CAFCS(I)=CCSY(I)+FLOAT(CCSM(I))/12.
         LAFCS(I)=LCSY(I)+FLOAT(LCSM(I))/12.
         MAFCS(I)=MCSY(I)+FLOAT(MCSM(I))/12.
52    CONTINUE
C     **** GENERATE THE PROMOTION PLANS ****
C     **** GENERATE THE COL PROMOTION PLAN ****
      WRITE(7,95)
      WRITE(7,110)
      WRITE(7,115)
      WRITE(7,120) PY,BY,CY,CPC(2),CLS(2),CLD(2),CCSY(2),CCSM(2),CAFCS(2
     *)
      DO 55 I=3,7
         WRITE(7,125) PY+I-2,BY+I-2,CY+I-2,CPC(I),CLS(I),CLD(I),CCSY(I),
     *CCSM(I),CAFCS(I)
55    CONTINUE
C     **** END OF THE COL PROMOTION PLAN ****
```

```
C     **** GENERATE THE LTC PROMOTION PLAN ****
      WRITE(8,100)
      WRITE(8,110)
      WRITE(8,115)
      WRITE(8,120) PY,BY,LY,LPC(2),LLS(2),LLD(2),LCSY(2),LCSM(2),LAFCS(2
     *)
      DO 60 I=3,7
         WRITE(8,125) PY+I-2,BY+I-2,LY+I-2,LPC(I),LLS(I),LLD(I),LCSY(I),
     *LCSM(I),LAFCS(I)
60    CONTINUE
C     **** END OF THE LTC PROMOTION PLAN ****
C     **** GENERATE THE MAJ PROMOTION PLAN ****
      WRITE(9,105)
      WRITE(9,110)
      WRITE(9,115)
      WRITE(9,120) PY,BY,MY,MPC(2),MLS(2),MLD(2),MCSY(2),MCSM(2),MAFCS(2
     *)
      DO 65 I=3,7
         WRITE(9,125) PY+I-2,BY+I-2,MY+I-2,MPC(I),MLS(I),MLD(I),MCSY(I),
     *MCSM(I),MAFCS(I)
65    CONTINUE
C     **** END OF THE MAJ PROMOTION PLAN ****
C     **** FORMATS FOR DATA INPUT ****
70    FORMAT (1X,2(I5))
75    FORMAT (1X,I5)
```

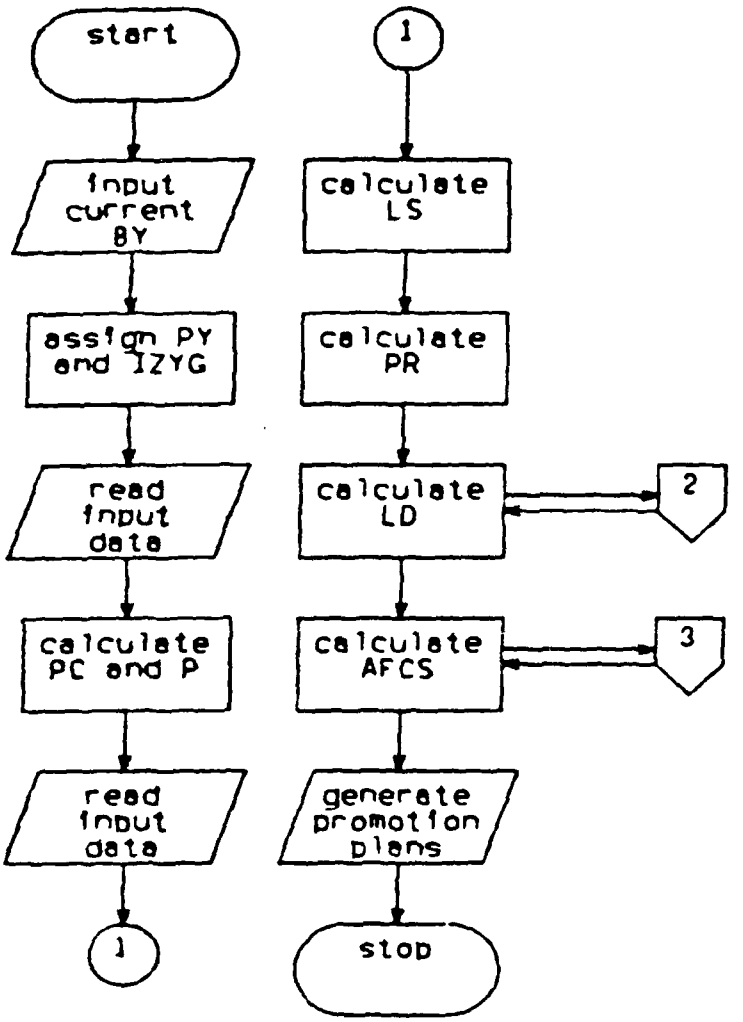
```
80     FORMAT (1X,3(I5))
85     FORMAT (1X,F5.0,2(I5))
90     FORMAT (1X,F5.2)
C      **** FORMATS FOR DATA OUTPUT ****
95     FORMAT ('1',28X,'COL PROM LIST',/)
100    FORMAT ('1',28X,'LTC PROM LIST',/)
105    FORMAT ('1',28X,'MAJ PROM LIST',/)
110    FORMAT (15X,'BRD',3X,'YEAR',5X,'PROM',5X,'LIST',3X,'LIST',5X,'AFCS
      *')
115    FORMAT (16X,'YR',4X,'GRP',6X,'CAP',5X,'SIZE',2X,'DURAT',3X,'YRS',2
      *X,'MOS')
120    FORMAT (2X,'ACTUAL',2X,'PY',I2,2X,I2,5X,I2,4X,I5,3X,F6.1,3X,I3,4X,
      *I3,2X,I2,1X,'(',F5.2,')')
125    FORMAT (10X,'PY',I2,2X,I2,5X,I2,4X,I5,3X,F6.1,3X,I3,5X,I2,2X,I2,1X
      *,'(',F5.2,')')
       STOP
       END
C      **** END OF MAIN PROGRAM  ****
C      **** START OF SUBROUTINES ****
C      ** THIS SUBROUTINE CALCULATES THE LIST DURATIONS FOR ALL RANKS **
       SUBROUTINE DUR(PR,UL,LR,MR,LE,LS,LD,PC)
       INTEGER I,J,LD(9),PC(9),UL(9),MR(15),LE(9)
       REAL PR(50),LS(15),LR(15)
       I=2
       J=1
```

```
LD(1)=0
LR(7)=100.
LR(1)=LS(1)
WHILE (LR(7).NE.0) DO
   UL(J)=AINT(LR(J)/PR(I)+.5)
   IF (UL(J).GT.12) THEN DO
        LR(J)=LR(J)-12*PR(I)
        LD(J)=12+LD(J)
        LR(J+1)=LS(J+1)
        I=I+1
   ELSE DO
        LD(J)=UL(J)+LD(J)
        MR(I)=12-UL(J)
        J=J+1
        LD(J)=MR(I)
        LE(J)=PR(I)*MR(I)
        IF (LE(J).GE.LS(J)) THEN DO
             LD(J)=AINT(LS(J)/PR(I)+.5)
             LR(J)=0.
             I=I+1
        ELSE DO
             LR(J)=LS(J)-LE(J)
             I=I+1
        END IF
   END IF
```

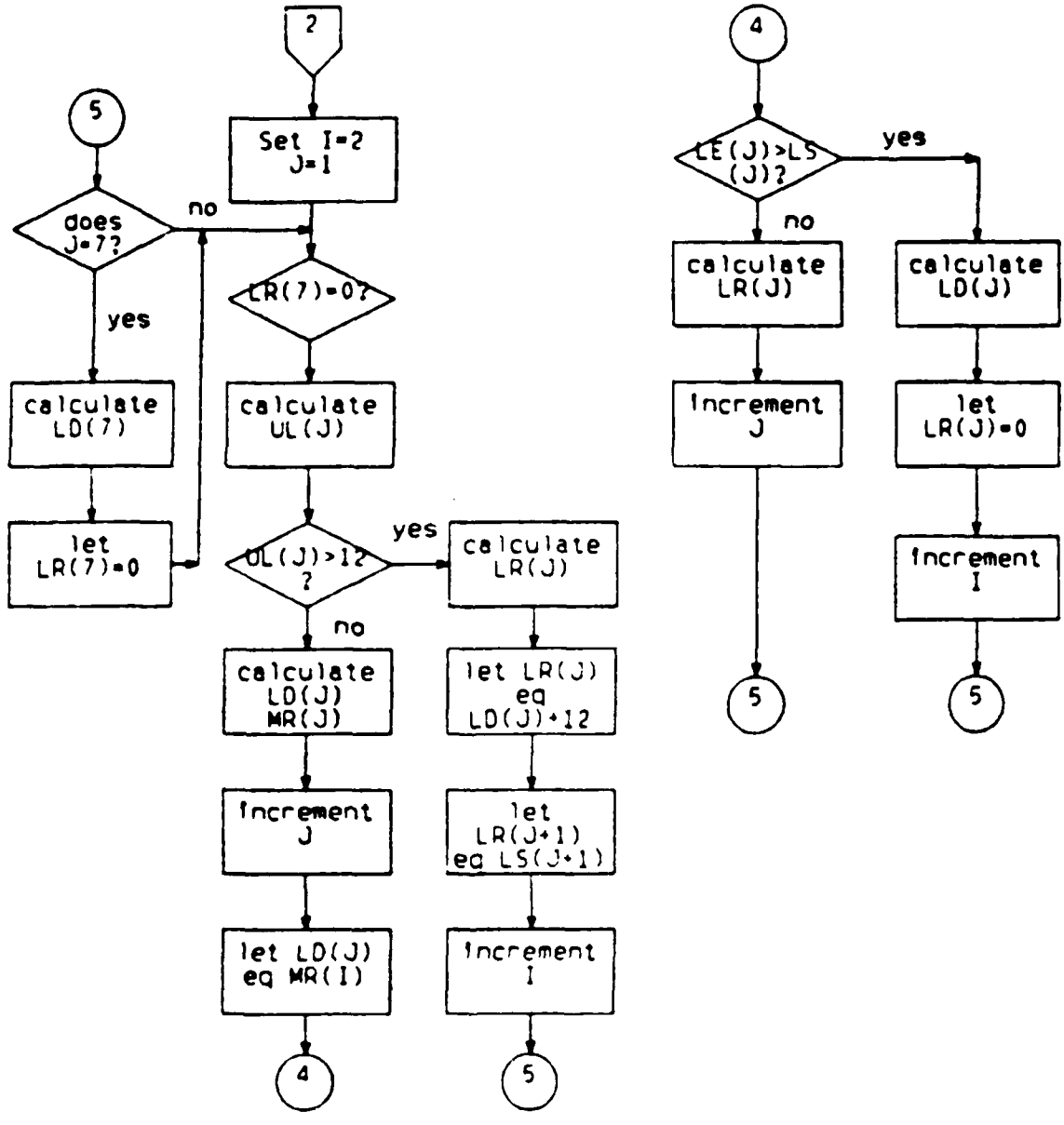
```
10        IF (J.EQ.7) THEN DO
               LD(J)=AINT(LS(J)/PR(J)+.5)
               LR(J)=0.
          ELSE DO
          END IF
       END WHILE
       RETURN
       END
C
C      **** THIS SUBROUTINE CALCULATES THE AFCS FOR ALL THREE RANKS ****
       SUBROUTINE AFCS(CSY,CSM,LD)
       INTEGER I,CSY(9),CSM(9),LD(9)
       DO 10 I=2,7
          CSY(I)=CSY(I-1)+(CSM(I-1)+LD(I)-12)/12
          IF ((CSM(I-1)+LD(I)-12).LT.0) CSY(I)=CSY(I)-1
          IF (CSY(I).EQ.CSY(I-1)) THEN DO
              CSM(I)=CSM(I-1)+(LD(I)-12)
          ELSE DO
               CSM(I)=(CSM(I-1)+(LD(I)-12))-((CSY(I)-CSY(I-1))*12)
          END IF
10     CONTINUE
       RETURN
       END
$ENTRY
```

APPENDIX C

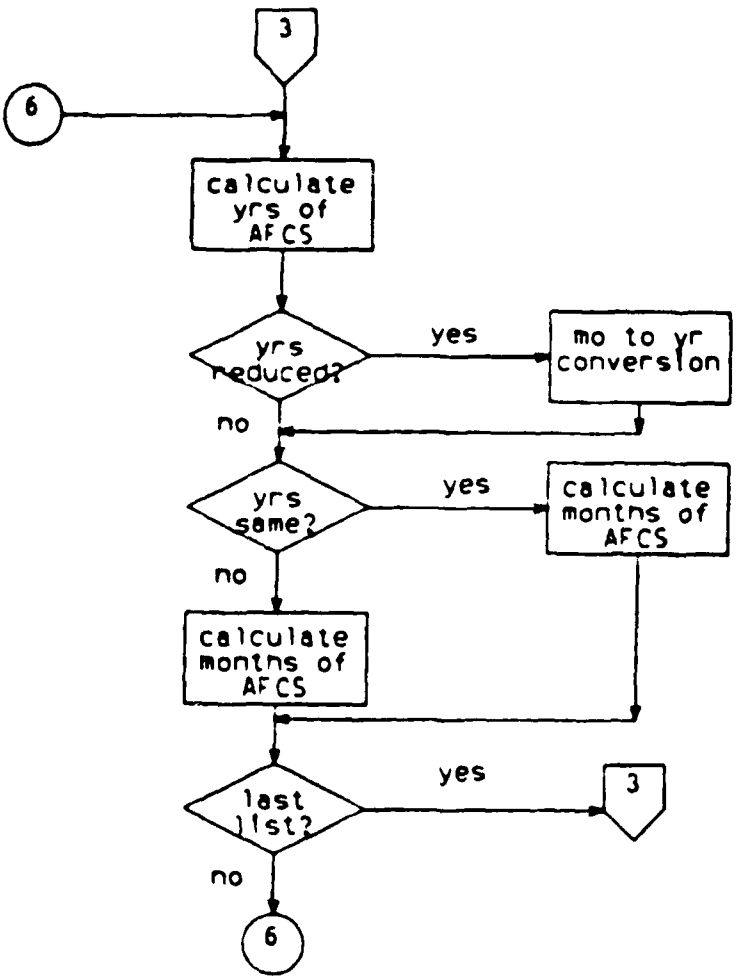
FLOW CHART OF PROPLAN



Flow Chart of Duration Subroutine



Flow Chart of AFCS Subroutine



APPENDIX D

INPUT FILES FOR PROPLAN

FILE FT10F001

```
CL(I)CD(I)
  559 -166
 425   65
 487    0
 484    0
 491    0
 476    0
LL(I) LD(I)
  890  123
 918   41
1149    0
1145    0
1165    0
1213    0
ML(I) MD(I)
  641  160
 628  146
 656    0
 636    0
 603    0
 573    0

COL INVENTORIES
 1265  991 2239
 942  969    0
 917  830    0 (CAC(I),CIC(I),CBC(I))
 839 1067    0
 888 1421    0
1141 1134    0
```

```
LTC INVENTORIES

 1551 2268 2113
1464 2528    0
1701 1822    0 (LAC(I),LIC(I),LBC(I))
1486 1601    0
1186 1615    0
 902 1733    0

MAJ INVENTORIES

  708 2161 2282
 775 2158    0
 642 2616    0 (MAC(I),MIC(I),MBC(I))
 649 2973    0
 734 3293    0
 993 3180    0


            FILE FT11F001

 CP(I)
   50
   50
   50
   50
   50
   50
FY85 LIST DATA
   45  485   58 (CAS(1),CIS(1),CBS(1))
  239 1609   79 (LAS(1),LIS(1),LBS(1))
  144 1686   30 (MAS(1),MIS(1),MBS(1))
PREVIOUS LISTS
  124   22    3 (CLR(1),CCSY(1),CCSM(1))
 1372   16    9 (LLR(1),LCSY(1),LCSM(1))
  820   11    4 (MLR(1),MCSY(1),MCSM(1))
```

FILE FT12F001

COL PR.	OPP.
4	(CAO)
47	(CIO)
10	(CBO)
LTC PR.	OPP.
13	(LAO)
67	(LIO)
10	(LBO)
MAJ PR.	OPP.
19	(MAO)
75	(MIO)
5	(MBO)

APPENDIX E

PROPLAN EXEC PROGRAMS

```
**********    TRANS EXEC    **********
&TRACE
&TYPE
&TYPE ENTER THE (FN) AND (FT) OF THE
&TYPE FILE TO BE TRANSFERRED TO APL:
&TYPE (FILE MUST BE A NUMERIC FILE)
&TYPE
&READ ARGS
&IF &N NE 2 &GOTO -BAD1
*CHECK TO SEE IF THE FILE EXISTS
STATE &1 &2 *
&IF &RC NE 0 &GOTO -BAD2
&TYPE
&TYPE ENTER THE NAME OF THE APL VARIABLE
&TYPE THAT WILL STORE THIS DATA:
&TYPE
&READ VARS &A
&TYPE
&TYPE ENTER THE NAME OF THE APL WS THAT
&TYPE YOU WANT THE VARIABLE &A TO BE
&TYPE STORED IN:
&TYPE
```

```
&READ VARS &WS
&TYPE
&TYPE IS &WS A NEW OR AN OLD WORKSPACE?
&TYPE ENTER 0-OLD, 1-NEW
&TYPE
&READ VARS &WST
&TYPE
&TYPE YOUR DATA WILL BE TRANSFERRED
&TYPE TO APL WS &WS
&TYPE
&TYPE DO YOU WANT TO KEEP THE CMS FILE?
&TYPE ENTER 0-NO, 1-YES
&TYPE
&READ VARS &KEEP
CP TERMINAL APL ON
&STACK )LOAD 990 CMSIO
&STACK &A CMSREAD
&STACK &1
&STACK &2
&STACK N
&STACK )WSID MYSPACE
&STACK )SAVE
&STACK )CLEAR
&IF &WST EQ 1 &GOTO -NEW
&STACK )LOAD &WS
```

```
&STACK )PCOPY MYSPACE &A
&STACK )SAVE
&GOTO -DROP
-NEW &STACK )WSID &WS
&STACK )PCOPY MYSPACE &A
&STACK )SAVE
-DROP &STACK )DROP MYSPACE
&STACK )OFF HOLD
EXEC APL
&IF &KEEP EQ 1 &GOTO -DONE
ERASE &1 &2 *
-DONE &EXIT 100
-BAD1 &TYPE YOU MUST ENTER TWO ARGUMENTS,
&TYPE TRY AGAIN BY ENTERING 'TRANS'
&TYPE
&EXIT 101
-BAD2 &TYPE &1 &2 DOES NOT EXIST, CHECK YOUR
&TYPE FLIST AND BEGIN AGAIN BY ENTERING 'TRANS'
&TYPE
&EXIT 102
**********    END OF TRANS EXEC    **********
**********    START OF PRO EXEC    **********
&TRACE
EXEC REMOTE RSPAN
CP SPOOL PRINTER CONT
```

```
-TOP &TYPE PROVIDE (FN) (FT) (FM) OF PROGRAM TO BE EXECUTED
&READ ARGS
*CHECK THE NO. OF ARGUMENTS AND USE (FM) OF '*' IF NOT GIVEN
&IF &N LT 2 &GOTO -BAD1
&IF &N GT 3 &GOTO -BAD2
&IF &N EQ 2 &ARGS &1 &2 *
*CHECK TO SEE IF THE FILE REQUESTED EXISTS
STATE &1 &2
&IF &RC EQ 0 &GOTO -FILEOK
&TYPE THIS FILE DOES NOT EXIST,
&TYPE START OVER BY ISSUING THE 'PRO' COMMAND
&EXIT 100
-FILEOK &FNAME = &1
&FTYPE = &2
&FMODE = &3
-INF1 &TYPE SPECIFY THE (FN) FOR THE
&TYPE FIRST INPUT DATA FILE:
&READ VARS &IFN1
&IFT1 = FT10F001
&IFM1 = *
*CHECK TO SEE IF THE FIRST FILE EXISTS
STATE &IFN1 &IFT1
&IF &RC = 0 &GOTO -INF2
&TYPE THE FIRST INPUT FILE DOES NOT EXIST, TRY AGAIN
&GOTO -INF1
```

```
-INF2 &TYPE SPECIFY THE (FN) FOR THE
&TYPE SECOND INPUT DATA FILE:
&READ VARS &IFN2
&IFT2 = FT11F001
&IFM2 = *
*CHECK TO SEE IF THE SECOND INPUT FILE EXISTS
STATE &IFN2 &IFT2
&IF &RC = 0 &GOTO -INF3
&TYPE THE SECOND INPUT FILE DOES NOT EXIST, TRY AGAIN
&GOTO -INF2
-INF3 &TYPE SPECIFY THE (FN) FOR THE
&TYPE THIRD INPUT DATA FILE:
&READ VARS &IFN3
&IFT3 = FT12F001
&IFM3 = *
*CHECK TO SEE IF THE THIRD INPUT FILE EXISTS
STATE &IFN3 &IFT3
&IF &RC = 0 &GOTO -OUTFI
&TYPE THE THIRD INPUT FILE DOES NOT EXIST, TRY AGAIN
&GOTO -INF3
*SPECIFY THE TARGET DATA FILES FOR OUTPUT
-OUTFI &TYPE SPECIFY THE TARGET DATA FILES FOR OUTPUT
&TYPE THE (FT) AND (FM) ARE SET AS 'DATA A1'
&TYPE USE ANY AUTHORIZED (FN) FOR EACH PLAN
&TYPE SPECIFY THE (FN) FOR THE COL PROMOTION
```

```
&TYPE PLAN, USE A (FN) SUCH AS 'CX...'
&READ ARGS
*CHECK THE NUMBER OF ARGUMENTS
&IF &N LT 1 &GOTO -BAD3
&IF &N GT 1 &GOTO -BAD4
&CPP = &1
&TYPE SPECIFY THE (FN) FOR THE LTC PROMOTION
&TYPE PLAN, USE A (FN) SUCH AS 'LX...'
&READ ARGS
*CHECK THE NUMBER OF ARGUMENTS
&IF &N LT 1 &GOTO -BAD3
&IF &N GT 1 &GOTO -BAD4
&LPP = &1
&TYPE SPECIFY THE (FN) FOR THE MAJ PROMOTION
&TYPE PLAN, USE A (FN) SUCH AS 'MX...'
&READ ARGS
*CHECK THE NUMBER OF ARGUMENTS
&IF &N LT 1 &GOTO -BAD3
&IF &N GT 1 &GOTO -BAD4
&MPP = &1
FILEDEF 07 DISK &CPP DATA (LRECL 80 RECFM F PERM
FILEDEF 08 DISK &LPP DATA (LRECL 80 RECFM F PERM
FILEDEF 09 DISK &MPP DATA (LRECL 80 RECFM F PERM
&TYPE WOULD YOU LIKE TO COMPILE A NEW PROGRAM?
&TYPE ENTER 0-NO, 1-YES
```

```
&READ VARS &COMP
&IF &COMP EQ 0 &GOTO -LISTING
EXEC WATFIV &FNAME * (XTYPE
-LISTING &TYPE DO YOU WANT TO SEE A COPY
&TYPE OF THE LISTING FILE?
&TYPE ENTER 0-NO, 1-YES
&READ VARS &LIST
&IF &LIST EQ 0 &GOTO -OUT
&TYPE DO YOU WANT THE LISTING AT THE
&TYPE TERMINAL OR TO THE PRINTER?
&TYPE ENTER 0-TERMINAL, 1-PRINTER
&READ VARS &MODE1
&IF &MODE1 EQ 0 TYPE &FNAME LISTING
&IF &MODE1 EQ 1 PRINT &FNAME LISTING
*ASK FOR COPIES OF THE PROMOTION PLANS
-OUT &TYPE DO YOU WANT TO SEE A COPY OF
&TYPE ANY OF THE PROMOTION PLANS?
&TYPE ENTER 0-NO, 1-YES
&READ VARS &PPL
&IF &PPL EQ 0 &GOTO -IN
&TYPE DO YOU WANT TO SEE A COPY
&TYPE OF THE COL PROMOTION PLAN?
&TYPE ENTER 0-NO, 1-YES
&READ VARS &COLPL
&IF &COLPL EQ 0 &GOTO -LPP
```

```
&TYPE DO YOU WANT THE PLAN AT THE
&TYPE TERMINAL OR TO THE PRINTER?
&TYPE ENTER 0-TERMINAL, 1-PRINTER
&READ VARS &MODE2
&IF &MODE2 EQ 0 TYPE &CPP DATA A1
&IF &MODE2 EQ 0 &GOTO -LPP
&TYPE DO YOU WANT TO PUT A HEADING
&TYPE ON THE PROMOTION PLAN?
&TYPE ENTER 0-NO, 1-YES
&READ VARS &H1
&IF &H1 EQ 0 PRINT &CPP DATA A1
&IF &H1 EQ 0 &GOTO -LPP
&TYPE ENTER THE HEADING DESIRED:
&READ STRING &CH1
&STACK I &CH1
&STACK FILE COL DATA
X &CPP DATA
PRINT COL DATA
ERASE COL DATA
-LPP &TYPE
&TYPE DO YOU WANT TO SEE A COPY
&TYPE OF THE LTC PROMOTION PLAN?
&TYPE ENTER 0-NO, 1-YES
&READ VARS &LTCPL
&IF &LTCPL EQ 0 &GOTO -MPP
```

```
&TYPE DO YOU WANT THE PLAN AT THE
&TYPE TERMINAL OR TO THE PRINTER?
&TYPE ENTER 0-TERMINAL, 1-PRINTER
&READ VARS &MODE3
&IF &MODE3 EQ 0 TYPE &LPP DATA A1
&IF &MODE3 EQ 0 &GOTO -MPP
&TYPE DO YOU WANT TO PUT A HEADING
&TYPE ON THE PROMOTION PLAN?
&TYPE ENTER 0-NO, 1-YES
&READ VARS &H2
&IF &H2 EQ 0 PRINT &LPP DATA A1
&IF &H2 EQ 0 &GOTO -MPP
&TYPE ENTER THE HEADING DESIRED:
&READ STRING &LH1
&STACK I &LH1
&STACK FILE LTC DATA
X &LPP DATA
PRINT LTC DATA
ERASE LTC DATA
-MPP &TYPE DO YOU WANT TO SEE A COPY
&TYPE OF THE MAJ PROMOTION PLAN?
&TYPE ENTER 0-NO, 1-YES
&READ VARS &MAJPL
&IF &MAJPL EQ 0 &GOTO -IN
&TYPE DO YOU WANT THE PLAN AT THE
```

```
&TYPE TERMINAL OR TO THE PRINTER?
&TYPE ENTER 0-TERMINAL, 1-PRINTER
&READ VARS &MODE4
&IF &MODE4 EQ 0 TYPE &MPP DATA A1
&IF &MODE4 EQ 0 &GOTO -IN
&TYPE DO YOU WANT TO PUT A HEADING
&TYPE ON THE PROMOTION PLAN?
&TYPE ENTER 0-NO, 1-YES
&READ VARS &H3
&IF &H3 EQ 0 PRINT &MPP DATA A1
&IF &H3 EQ 0 &GOTO -IN
&TYPE ENTER THE HEADING DESIRED:
&READ STRING &MH1
&STACK I &MH1
&STACK FILE MAJ DATA
X &MPP DATA
PRINT MAJ DATA
ERASE MAJ DATA
-IN &TYPE DO YOU WANT TO SEE A COPY OF
&TYPE ANY OF THE INPUT FILES?
&TYPE ENTER 0-NO, 1-YES
&READ VARS &CIF
&IF &CIF = 0 &GOTO -TRANS
&TYPE DO YOU WANT TO SEE A COPY
&TYPE OF THE FIRST INPUT FILE?
```

```
&TYPE ENTER 0-NO, 1-YES
&READ VARS &INF1
&IF &INF1 = 0 &GOTO -IN2
&TYPE DO YOU WANT THE FILE AT THE
&TYPE TERMINAL OR TO THE PRINTER?
&TYPE ENTER 0-TERMINAL, 1-PRINTER
&READ VARS &MODE5
&IF &MODE5 EQ 0 TYPE &IFN1 &IFT1 &IFM1
&IF &MODE5 EQ 0 &GOTO -IN2
&TYPE DO YOU WANT TO PUT A HEADING
&TYPE ON THE INPUT FILE?
&TYPE ENTER 0-NO, 1-YES
&READ VARS &H4
&IF &H4 EQ 0 PRINT &IFN1 &IFT1 &IFM1
&IF &H4 EQ 0 &GOTO -IN2
&TYPE ENTER THE HEADING DESIRED:
&READ STRING &IF1H
&STACK I &IF1H
&STACK FILE INP1 DATA
X &IFN1 &IFT1
PRINT INP1 DATA
ERASE INP1 DATA
-IN2 &TYPE DO YOU WANT TO SEE A COPY
&TYPE OF THE SECOND INPUT FILE?
&TYPE ENTER 0-NO, 1-YES
```

```
&READ VARS &INF2
&IF &INF2 = 0 &GOTO -IN3
&TYPE DO YOU WANT THE FILE AT THE
&TYPE TERMINAL OR TO THE PRINTER?
&TYPE ENTER 0-TERMINAL, 1-PRINTER
&READ VARS &MODE6
&IF &MODE6 EQ 0 TYPE &IFN2 &IFT2 &IFM2
&IF &MODE6 EQ 0 &GOTO -IN3
&TYPE DO YOU WANT TO PUT A HEADING
&TYPE ON THE INPUT FILE?
&TYPE ENTER 0-NO, 1-YES
&READ VARS &H5
&IF &H5 EQ 0 PRINT &IFN2 &IFT2 &IFM2
&IF &H5 EQ 0 &GOTO -IN3
&TYPE ENTER THE HEADING DESIRED:
&READ STRING &IF2H
&STACK I &IF2H
&STACK FILE INP2 DATA
X &IFN2 &IFT2 &IFM2
PRINT INP2 DATA
ERASE INP2 DATA
-IN3 &TYPE DO YOU WANT TO SEE A COPY
&TYPE OF THE THIRD INPUT FILE?
&TYPE ENTER 0-NO, 1-YES
&READ VARS &INF3
```

```
&IF &INF3 = 0 &GOTO -TRANS
&TYPE DO YOU WANT THE FILE AT THE
&TYPE TERMINAL OR TO THE PRINTER?
&TYPE ENTER 0-TERMINAL, 1-PRINTER
&READ VARS &MODE7
&IF &MODE7 EQ 0 TYPE &IFN3 &IFT3 &IFM3
&IF &MODE7 EQ 0 &GOTO -TRANS
&TYPE DO YOU WANT TO PUT A HEADING
&TYPE ON THE INPUT FILE?
&TYPE ENTER 0-NO, 1-YES
&READ VARS &H6
&IF &H6 EQ 0 PRINT &IFN3 &IFT3 &IFM3
&IF &H6 EQ 0 &GOTO -TRANS
&TYPE ENTER THE HEADING DESIRED?
&READ STRING &IF3H
&STACK I &IF3H
&STACK FILE INF3 DATA
X &IFN3 &IFT3
PRINT INF3 DATA
ERASE INF3 DATA
-TRANS &TYPE DO YOU WANT TO EXECUTE THE TRANS EXEC?
&TYPE ENTER 0-NO, 1-YES
&READ VARS &TRANS
&IF &TRANS = 0 &GOTO -NEXT
-TRAG &TYPE BE SURE THAT ANY FILES TRANSFERRED TO APL
```

```
&TYPE HAVE THE ALPHANUMERIC HEADINGS REMOVED
EXEC TRANS
&TYPE DO YOU WANT TO EXECUTE THE TRANS EXEC AGAIN?
&TYPE ENTER 0-NO, 1-YES
&READ VARS &TRANSA
&IF &TRANSA = 0 &GOTO -NEXT
&GOTO -TRAG
-NEXT &TYPE DO YOU WANT TO RUN THE MODEL AGAIN?
&TYPE ENTER 0-NO, 1-YES
&READ VARS &AGAIN
&IF &AGAIN EQ 1 &GOTO -CHANGE
&TYPE DO YOU WANT TO REPLACE THE ORIGINAL
&TYPE INPUT FILES AS THE PERMANENT COPIES?
&TYPE ENTER 0-NO, 1-YES
&READ VARS &PC
&IF &PC = 0 &GOTO -QUIT
-CHTC1 &TYPE DO YOU WANT TO REPLACE
&TYPE THE FIRST ORIGINAL FILE AS
&TYPE THE PERMANENT INPUT COPY?
&TYPE ENTER 0-NO, 1-YES
&READ VARS &PC1
&IF &PC1 EQ 0 &GOTO -CHTC2
REN FILE &IFT1 &IFM1 TEMP1 = =
REN &TFN1 &IFT1 &IFM1 FILE = =
REN TEMP1 &IFT1 &IFM1 &TFN1 = =
```

```
&TYPE YOUR ORIGINAL INPUT FILE IS NOW
&TYPE (FN) FILE, YOUR CHANGE COPY IS
&TYPE NOW (FN) &TFN1
&TYPE DO YOU WANT TO ERASE YOUR CHANGE
&TYPE COPY OF THE INPUT DATA FILE?
&TYPE ENTER 0-NO, 1-YES
&READ VARS &ER1
&IF &ER1 = 0 &GOTO -CHTC2
ERASE &TFN1 &IFT1 &IFM1
-CHTC2 &TYPE DO YOU WANT TO REPLACE
&TYPE THE SECOND ORIGINAL FILE AS
&TYPE THE PERMANENT INPUT COPY?
&TYPE ENTER 0-NO, 1-YES
&READ VARS 3.1
&IF 3.1 EQ 0 &GOTO -CHTC3
REN FILE &IFT2 &IFM2 TEMP2 = =
REN &TFN2 &IFT2 &IFM2 FILE = =
REN TEMP2 &IFT2 &IFM2 &TFN2 = =
&TYPE YOUR ORIGINAL INPUT FILE IS NOW
&TYPE (FN) FILE, YOUR CHANGE COPY IS
&TYPE NOW (FN) &TFN2
&TYPE DO YOU WANT TO ERASE YOUR CHANGE
&TYPE COPY OF THE INPUT DATA FILE?
&TYPE ENTER 0-NO, 1-YES
&READ VARS &ER2
```

```
&IF &ER2 = 0 &GOTO -CHTC3
ERASE &TFN2 &IFT2 &IFM2
-CHTC3 &TYPE DO YOU WANT TO REPLACE
&TYPE THE THIRD ORIGINAL FILE AS
&TYPE THE PERMANENT INPUT COPY?
&TYPE ENTER 0-NO, 1-YES
&READ VARS &PC3
&IF &PC3 EQ 0 &GOTO -QUIT
REN FILE &IFT3 &IFM3 TEMP3 = =
REN &TFN3 &IFT3 &IFM3 FILE = =
REN TEMP3 &IFT3 &IFM3 &TFN3 = =
&TYPE YOUR ORIGINAL INPUT FILE IS NOW
&TYPE (FN) FILE, YOUR CHANGE COPY IS
&TYPE NOW (FN) &TFN3
&TYPE DO YOU WANT TO ERASE YOUR CHANGE
&TYPE COPY OF THE INPUT DATA FILE?
&TYPE ENTER 0-NO, 1-YES
&READ VARS &ER3
&IF &ER3 = 0 &GOTO -QUIT
ERASE &TFN3 &IFT3 &IFM3
&IF &AGAIN = 1 &GOTO -TOP
-QUIT CP SPOOL PRINTER CLOSE NOCONT
EXEC REMOTE OFF
-CHANGE &TYPE DO YOU WANT TO MAKE TEMPORARY
&TYPE COPIES OF THE ORIGINAL DATA FILES?
```

```
&TYPE ENTER 0-NO, 1-YES
&READ VARS &TCS
&IF &TCS EQ 0 &GOTO -CHD1
-CH1 &TYPE SPECIFY THE TEMP (FN) FOR THE
&TYPE FIRST INPUT DATA FILE:
&READ VARS &TFN1
COPY &IFN1 &IFT1 &IFM1 &TFN1 = = (REPL
&TYPE YOUR ORIGINAL INPUT DATA FILE
&TYPE NOW RESIDES UNDER THE (FN) OF &TFN1
&TYPE YOUR CHANGE COPY NOW RESIDES
&TYPE UNDER THE (FN) OF &IFN1
-CHD1 &TYPE DO YOU WANT TO CHANGE ANY DATA
&TYPE IN THE FIRST INPUT DATA FILE?
&TYPE ENTER 0-NO, 1-YES
&READ VARS &CHIF1
&IF &CHIF1 EQ 0 &GOTO -CH2
&TYPE YOU MAY NOW CHANGE DATA IN
&TYPE THE FIRST INPUT DATA FILE:
XEDIT &IFN1 &IFT1 &IFM1
-CH2 &IF &TCS EQ 0 &GOTO -CHD2
&TYPE SPECIFY THE TEMP (FN) FOR THE
&TYPE SECOND INPUT DATA FILE:
&READ VARS &TFN2
COPY &IFN2 &IFT2 &IFM2 &TFN2 = = (REPL
&TYPE YOUR ORIGINAL INPUT DATA FILE
```

```
&TYPE NOW RESIDES UNDER THE (FN) OF &TFN2
&TYPE YOUR CHANGE COPY NOW RESIDES
&TYPE UNDER THE (FN) OF &IFN2
-CHD2 &TYPE DO YOU WANT TO CHANGE ANY DATA
&TYPE IN THE SECOND INPUT DATA FILE?
&TYPE ENTER 0-NO, 1-YES
&READ VARS &CHIF2
&IF &CHIF2 EQ 0 &GOTO -CH3
&TYPE YOU MAY NOW CHANGE DATA IN
&TYPE THE SECOND INPUT DATA FILE:
XEDIT &IFN2 &IFT2 &IFM2
-CH3 &IF &TCS EQ 0 &GOTO -CHD3
&TYPE SPECIFY THE TEMP (FN) FOR THE
&TYPE THIRD INPUT DATA FILE:
&READ VARS &TFN3
COPY &IFN3 &IFT3 &IFM3 &TFN3 = = (REPL
&TYPE YOUR ORIGINAL INPUT DATA FILE
&TYPE NOW RESIDES UNDER THE (FN) OF &TFN3
&TYPE YOUR CHANGE COPY NOW RESIDES
&TYPE UNDER THE (FN) OF &IFN3
-CHD3 &TYPE DO YOU WANT TO CHANGE ANY DATA
&TYPE IN THE THIRD INPUT DATA FILE?
&TYPE ENTER 0-NO, 1-YES
&READ VARS &CHIF3
&IF &CHIF3 EQ 0 &GOTO -TOP
```

```
&TYPE YOU MAY NOW CHANGE DATA IN
&TYPE THE THIRD INPUT DATA FILE:
XEDIT &IFN3 &IFN3 &IFM3
&GOTO -TOP
-BAD1 &TYPE TOO FEW ARGUMENTS WERE SPECIFIED,
&TYPE START OVER AND ISSUE THE 'PRO' COMMAND
&EXIT 101
-BAD2 &TYPE TOO MANY ARGUMENTS WERE SPECIFIED,
&TYPE START OVER AND ISSUE THE 'PRO' COMMAND
&EXIT 102
-BAD3 &TYPE YOU MUST USE 1 ARGUMENT, TRY AGAIN
&GOTO -OUTFI
-BAD4 &PRINT YOU MUST USE ONLY 1 ARGUMENT, TRY AGAIN
&GOTO -OUTFI
```

LIST OF REFERENCES

1. U.S. Department of the Defense, Department of Defense Directive 1320.12, *Defense Officer Promotion Program*, Washington, D.C., March 1983.

2. Styron, Howard T., *The Application of Microcomputer Spreadsheets to Produce the U.S. Army Five Year Field Grade Officer Promotion Plan*, Masters Thesis, Naval Postgraduate School, Monterey, December 1984.

3. Rand Corporation Report R2276/1-AF, *The Evolution of Military Officer Personnel Management Policies: A Preliminary Study with Parallels from Industry-Executive Summary*, by J.H. Hayes, August 1978.

4. Rand Corporation Report R2276-AF, *The Evolution of Military Officer Personnel Management Policies: A Preliminary Study with Parallels from Industry*, by J.H. Hayes, August 1978.

5. U.S. Congress, House. *The Defense Officer Personnel Management Act*, 96th Cong., 2nd sess., 1980. Report No. 96-1462, 13 November 1980.

6. U.S. Army War College, *Defense Officer Personnel Management Act (DOPMA): Selected Issues*, Study Group Draft Report, January 1979.

7. U.S. Army War College, *Officer Personnel Management: 'A Historical Perspective'*, by G.R. Iverson, May 1978.

8. U.S. Department of the Army, AR 624-100, *Promotion of Officers on Active Duty*, Chapter 2, 20 October 1975.

9. U.S. Department of the Army, Military Personnel Center, *Officer Force Implementation Plan, FY84 - FY90*, Alexandria, Virginia, 4 September 1984.

10. Naval Postgraduate School Technical Note, TN-VM-04 *Using Exec Files Under CMS*, February, 1984.

INITIAL DISTRIBUTION LIST

	No. Copies
1. Defense Technical Information Center Cameron Station Alexandria, Virginia 22304-6145	2
2. Superintendent Attn: Library, Code 0142 Naval Postgraduate School Monterey, California 93943	2
3. LTC Jack B. Gafford Attn: Code 55 Gf Naval Postgraduate School Monterey, California 93943	2
4. Professor R. Kevin Wood Attn: Code 55 Wd Naval Postgraduate School Monterey, California 93943	2
5. Commander, MILPERCEN Attn: DAPC-PLF (CPT. Carter Thomas) 200 Stovall Street Alexandria, Virginia 22332	2
6. CPT William R. Thompson 34 Woodlawn DeRidder, Louisiana 70634	3
7. CPT Pat Cannon 1930 Patton Place Lithonia, Georgia 30058	1